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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the manufacturing interests, covering in a practical manner the mechanical, power, foundry and allied field. Published by The MacLean Publishing Company, Limited, Toronto, Montreal, Winnipeg and London, Eng.

Vol. XVIII—No. 5

Publication Office: Toronto, August 2, 1917

Subscription Price
\$3.00 per Year

Grey Iron Castings

Our foundry is excellently equipped for making grey iron or semi-steel castings, both large and small.

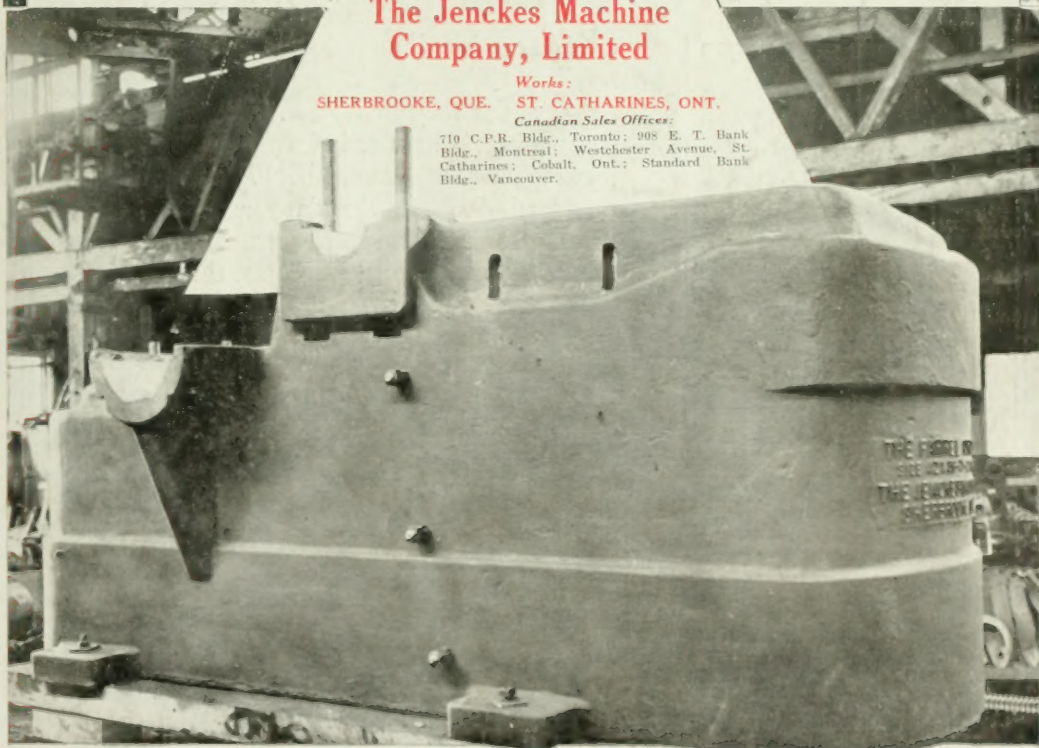
We also make
Brass, Bronze
and Composition Castings
Let Us Quote on Your Requirements.

A recent casting weighing 35 tons is shown below. We have made a number of these large crusher frames and are prepared to handle even larger pieces.

The Jenckes Machine Company, Limited

Works:
SHERBROOKE, QUE. ST. CATHARINES, ONT.

Canadian Sales Offices:
710 C.P.R. Bldg., Toronto; 908 E. T. Bank Bldg., Montreal; Westchester Avenue, St. Catharines; Cobalt, Ont.; Standard Bank Bldg., Vancouver.

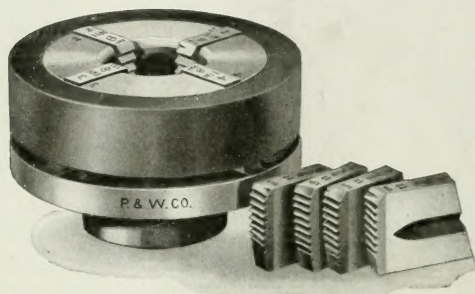
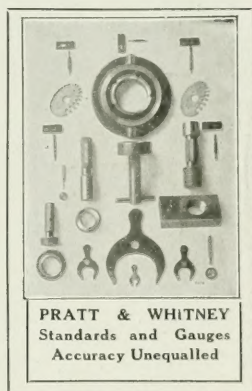


CANADIAN MACHINERY

SMALL TOOLS

PROMPT SERVICE

is assured at our nearest store where P. & W. Small Tools are carried in stock for immediate delivery. Place your order there to-day.



P. & W. Die-Stock Dies

These dies are practically solid when in use and can be adjusted 1-32 in. larger or smaller. The chasers can be quickly removed for the purpose of renewal or sharpening. Standard sizes furnished include U. S. Standard, Whitworth Standard, S. A. E. Standard and "V" form, all right hand; also special right-hand Briggs Standard taper pipe thread.

The Pratt & Whitney policy of highest quality materials, together with the necessary refinement and accuracy, is maintained.

PRATT & WHITNEY CO.

of Canada, Limited

Works: DUNDAS, ONTARIO

MONTREAL
723 Drummond Bldg.

TORONTO
1002 C.P.R. Bldg.

WINNIPEG
1205 McArthur Bldg.

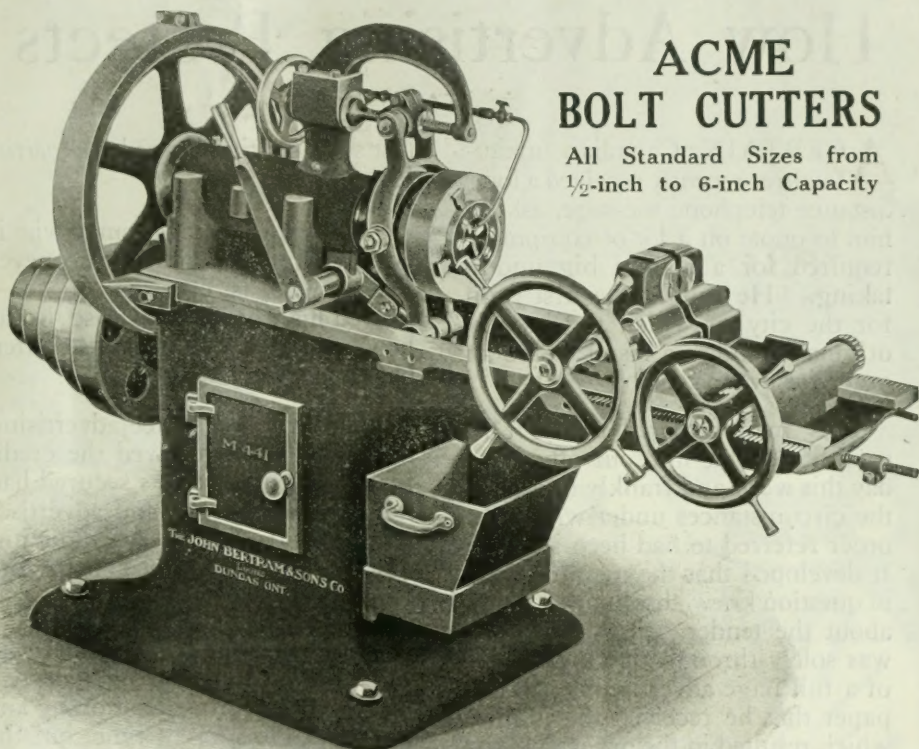
VANCOUVER
B.C. Equipment Co.



BERTRAM MACHINE TOOLS

ACME BOLT CUTTERS

All Standard Sizes from
 $\frac{1}{2}$ -inch to 6-inch Capacity



Supplied with Leadscrew Attachment for Stay Bolts or other work requiring special Accuracy of Pitch.

WRITE US FOR FULL DETAILS ON ANY MACHINE OR MACHINES
IN WHICH YOU ARE INTERESTED

The John Bertram & Sons Company Limited

MONTREAL
723 Drummond Bldg.

Dundas, Ontario, Canada
TORONTO
1002 C.P.R. Bldg.

VANCOUVER
609 Bank of Ottawa Bldg.

WINNIPEG
1205 McArthur Bldg.



If any advertisement interests you, tear it out now and place with letters to be answered.

The Publisher's Page

TORONTO

August 2, 1917

How Advertising Protects

A CERTAIN Canadian manufacturer recently received a long distance telephone message, asking him to quote on a lot of equipment required for a certain big undertaking. He caught the first train for the city in which the inquiry originated and as a result closed an order for over \$50,000!

This manufacturer took the trouble to come into our office one day this week and frankly told us of the circumstances under which the order referred to had been secured. It developed that the manufacturer in question knew absolutely nothing about the tender being out and it was solely through the appearance of a full page advertisement in our paper that he received the inquiry which resulted in the order for \$50,000.

Here was a manufacturer, a keen wide-awake man, with a supposedly efficient sales organization, equipped for keeping in touch with all worth while developments. Had this manufacturer relied solely upon his sales staff he would have lost out but, as we said before, being keen and wide-awake, he had provided for

just such contingencies by *advertising*.

Advertising—the salesman who is everywhere at all times, who never sleeps, who is ever on guard,—proved his worth in this case just as he has shown his mettle so often before.

Even in this instance advertising might not have received the credit for the splendid results secured had not our good friend and advertiser taken the trouble to ascertain just how and why he received the inquiry which led to the order.

Naturally the manufacturer in question asked us for obvious reasons to refrain from mentioning any names at the present time, but the facts were so interesting that we felt impelled to pass them on that a consideration of them might strengthen the already unwavering conviction of those who have advertised long and believe fully in the power of advertising, and encourage those who are almost but not quite convinced that advertising is a necessary force in business. And there are still a few in this state of mind.



Quality

**STEEL & IRON
PRODUCTS
OF
EVERY DESCRIPTION**

Service

**THE
STEEL COMPANY
OF
CANADA**

HAMILTON **LIMITED** **MONTREAL**

The central graphic features a large, white, cloud-like shape that serves as a backdrop for the company's name and product list. Within this shape, various steel products are illustrated, including bolts, nuts, washers, rivets, and structural beams. The background of the entire advertisement is a detailed black and white illustration of a steel mill interior, showing workers in hard hats and safety gear operating machinery and handling large pieces of steel.

If any advertisement interests you, tear it out now and place with letters to be answered.



This Wonderful Metal

is made in different Grades and can be adapted for
A MULTITUDE OF OPERATIONS.

Remarkable Results are Being Obtained

in machining Steel, Iron, Bronze, Brass,
Ivory, Celluloid, etc.

DIES OF ALL DESCRIPTIONS

are cast for hot or cold drawn work.

*Write us for particulars, stating the class of work
you are on, and what your difficulties are. Our
Engineering Staff is at your disposal.*

DELORO SMELTING & REFINING CO., LIMITED

Head Office

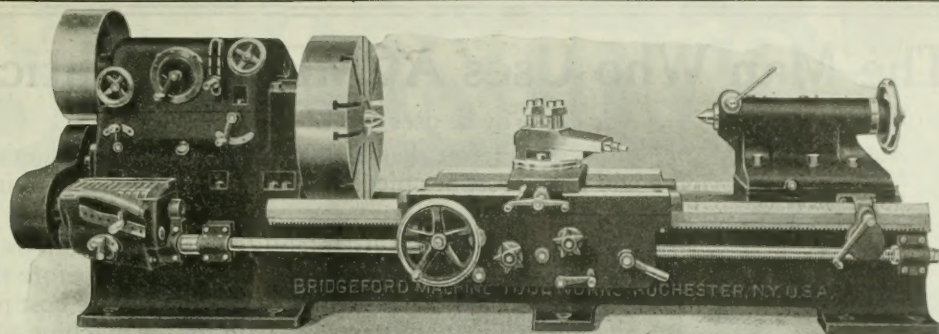
DELORO, ONTARIO

TORONTO

200 King Street West

MONTREAL

315 Craig Street West



Bridgeford 36" Patent Geared Head Lathe HEAVY PATTERN

Accurate

This is one of those heavy duty "Bridgefords," celebrated for its accuracy and speed. Has ideal combination of cutting speeds and changes are made with quickness and ease. You can bank on this lathe to go through the toughest proposition in quick order where the average lathe would fall down.

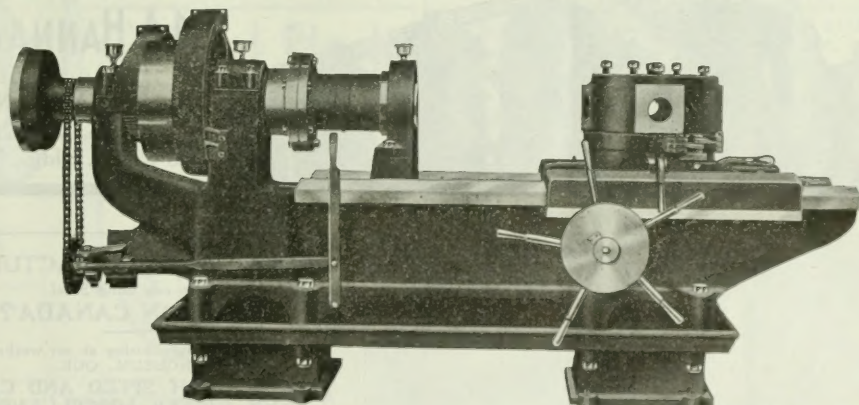
All Bridgeford Lathes are built to cope with the severest requirements. Let us tell you more about them.

Bridgeford Machine Tool Works, Rochester, N.Y.
161 WINTON ROAD

IN STOCK—FOR IMMEDIATE SHIPMENT

SUBJECT TO PRIOR SALE

H.E.W. Boring Lathes To Handle Shells Up To 6"



MADE IN CANADA

SPECIFICATIONS ON REQUEST

HYDE ENGINEERING WORKS

CONSULTING AND MANUFACTURING ENGINEERS

P.O. Box 1185

27 William Street, MONTREAL, P.Q.

If any advertisement interests you, tear it out now and place with letters to be answered.

The Man Who Uses ACME Automatics

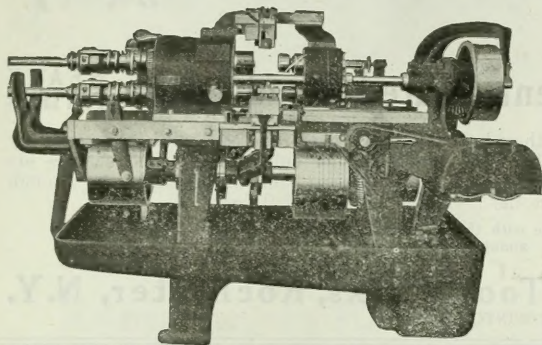
The ACME
Automatic
Multiple
Spindle
Screw
Machine,
Capacities
Up to $3\frac{3}{4}$ "
Diameter

Ask him why he uses them?

He will tell you that better finish, greater production and lower cost per piece were his reasons for specifying Acmes.

Moreover, the Acme Adaptability to such operations as cross milling, drilling, slabbing and slotting before the work leaves the machine means a saving in the cost per piece which in many cases has paid for the machine.

Let us show you the true economy of the Acme Way Send a sample or blue print.



The National Acme Co.
Cleveland Ohio

New England Plant: Windsor, Vermont
Canadian Plant: Montreal, Quebec

BRANCH OFFICES: NEW YORK, BOSTON,
CHICAGO, DETROIT, ATLANTA, SAN FRANCISCO
REPRESENTATIVES IN FOREIGN COUNTRIES

Makers of Gridley Single and Multiple Spindle Automatics at Windsor, Vermont; and Acme Automatics, Threading Dies, and Screw Machine Products at Cleveland, Ohio.

Coal
Coke
Iron Ore

Pig Iron

FOUNDRY & MALLEABLE

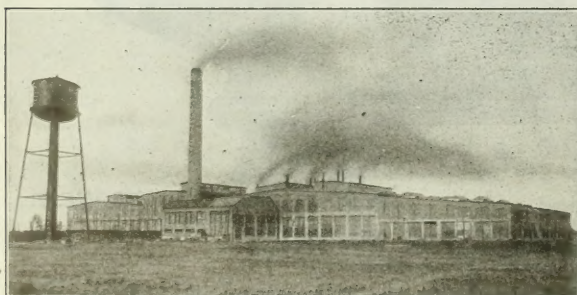
Victoria

Made by The Canadian Furnace Co.
Port Colborne, Ontario, Canada.

M.A. HANNA & CO.

Sales Agents:
CLEVELAND

Canadian Office:
703 C.P.R. Bldg., Toronto



Works: LONGUEUIL, QUE.

CANADIAN MANUFACTURERS
are you using Steel
MADE IN CANADA?

We are manufacturing at our works at
LONGUEUIL, QUE.

**SPECIAL HIGH SPEED AND CARBON
TOOL STEELS, MISCELLANEOUS
SHOP TOOLS, GAUGES, Etc.**

**ARMSTRONG WHITWORTH of CANADA
LIMITED**

HEAD OFFICE: 298-300 St. James St., Montreal
27 King William Street, HAMILTON
Branches: Dominion Bank Bldg., TORONTO
McArthur Bldg., WINNIPEG, MAN.

Steel Castings



Our lengthy and varied experience in making Manganese, Vanadium, Titanium, castings assures you of getting the best of products.

Anything in castings from 1 lb. to 50 tons is right in our line. Ships' castings our specialty.

Castings made true to specifications and patterns.



Propeller shaft
Bearing for Ice-
Breaker "John D.
Hazen."

Canadian Steel Foundries Limited

GENERAL OFFICE:
Transportation Bldg.
Montreal, Canada.

LONDON (England) OFFICE:
Trafalgar House, Waterloo
Place

WORKS:
Welland, Ont.; Point St.
Charles, Montreal; Longue
Pointe, Montreal.

We guarantee shipment
within 24 hours of
receipt of order

"Extra"
"Special"
"High
Speed" **Tool Steels**

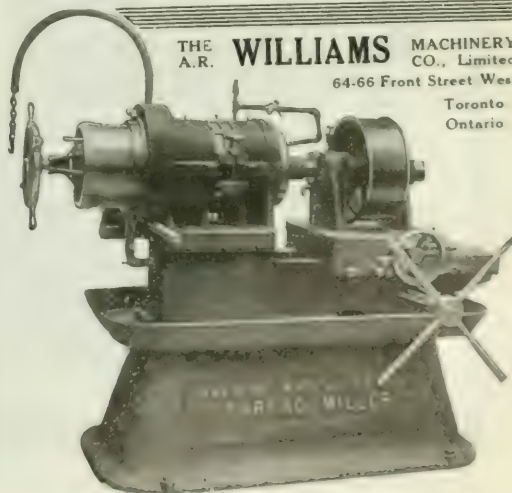
Made in
Sweden
from selected
Dannemora Ore

We also carry in stock
Solid and Hollow Drill
Steel, Die Blocks, "SIS-
CO" Welding Wire, Drill
Rod and Swedish Iron.

Swedish Steel & Importing Co., Ltd.
MONTREAL, QUE.

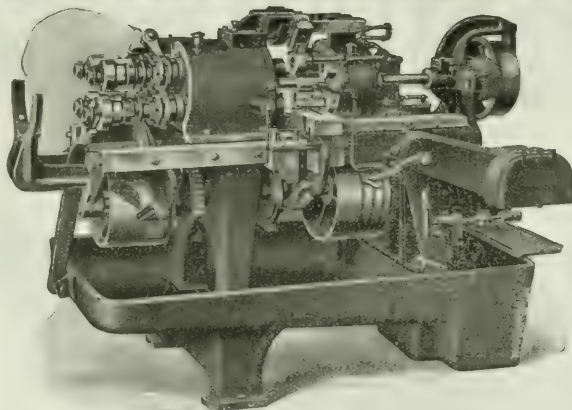
The Life of a Thread Miller

Depends not upon the amount of work it does, but the ease and thoroughness with which the work is done. These Thread Millers are noted for these qualities. Its quality of work is unrivalled. Our Service Department will give you all the particulars. Write us!



THE WILLIAMS MACHINERY
A.R. CO., Limited
64-66 Front Street West
Toronto
Ontario

THE JOHNSON FRICTION CLUTCH



Courtesy: National-Acme Mfg. Co., Cleveland, Ohio.

The Johnson Friction Clutch is incorporated by the leading automatic machine builders. Note the automatic machines shown on this page.

National-Acme Mfg. Co., Cleveland, O., say:

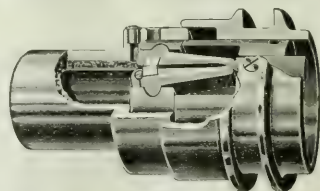
"It will pull a heavy load. Very easy to shift. Fitted well into the plan of the machine."

Cleveland Automatic Machine Co. say:

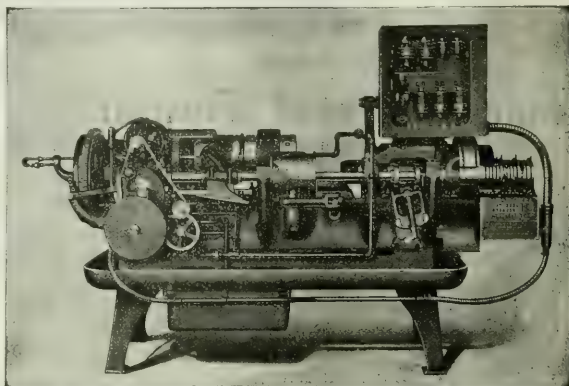
"Service of this kind requires a friction clutch of correct design and the Johnson Friction Clutch proves entirely satisfactory."

National-Acme Mfg. Co., Windsor, Vt., said:

"It works very successfully. We will use them in the future."



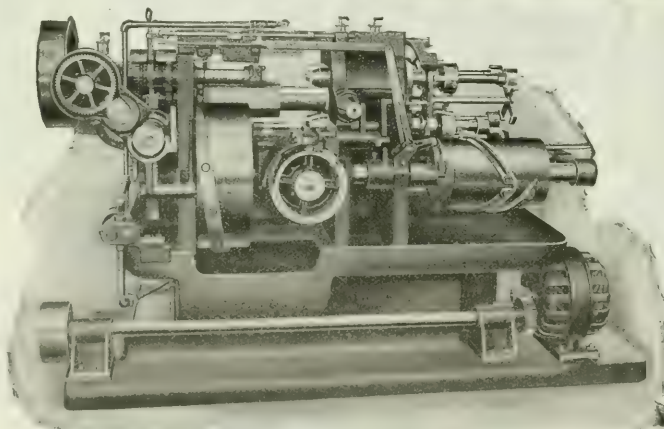
Single Clutch, Sectioned, showing Interior.



Courtesy: Cleveland Automatic Mach. Co., Cleveland, Ohio.

Our Engineering Department is maintained for your benefit and our engineers will give you any information you may desire. Write to-day, sending a sketch of the part of your machine into which you wish to work the Johnson Friction Clutch. We will draw in the proper size of clutch.

This is part of the service we render our customers and we invite you to use it as freely as you desire.



Courtesy: National Acme Mfg. Co., Windsor, Vt.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

England—The Etandem Co., 159 Gt. Portland St., London. Canada—Williams & Wilson, Ltd., 320 St. James St., Montreal.
W., England. Sole Agents for the British Isles. Canadian Fairbanks-Morse Co., Limited, Toronto.
AUSTRALIA: Edwin Wood, Pty., Hardware Chambers, 231 Elizabeth St., Melbourne, Victoria.

The Fairley Davidson Steel Co., Inc.

SPECIALISTS

Hot Working Steels
High Strength Steels
High Speed Steel
Tool and Die Steels
Magnet Steels
Non-Changeable Die Steel

Brand Name:
"Xtof" and "Precision"
"Hehtemnd"
RUSHITOFF No. 6
"Fondwot" and "Giant"
Tungsten or Chrome
Nugget "B" oil hardening

CHROME VANADIUM, oil hardening or case hardening

CHROME NICKEL, oil hardening or case hardening

Steam Hammer Forgings to Sketch

We guarantee to supply the correct steel at once, eliminating costly experiments

We carry a complete stock at our New York Warehouse, 124 Maiden Lane, New York City

Canadian Agents:

The Canadian Utilities Steel & Engineering, Limited

149 Craig Street West, Montreal, Canada

We carry a complete stock at our Montreal Warehouse

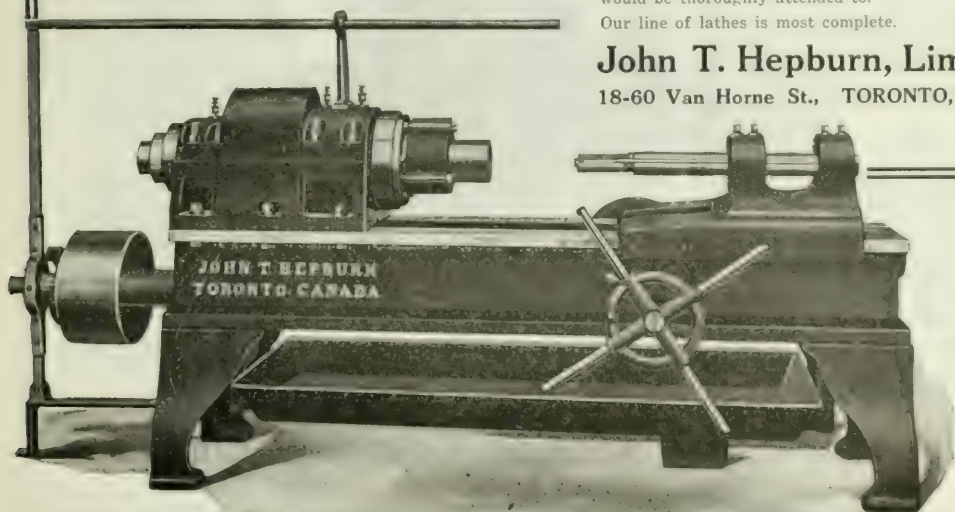
Its Construction and Achievements

The array of performances this lathe has made in boring shells up to 6' is sufficient to warrant the confidence that our clients express in them. While speed is a great asset, yet the quality of work done and the condition of the machine after excess use have excited the most favorable comment. An inquiry would be thoroughly attended to.

Our line of lathes is most complete.

John T. Hepburn, Limited

18-60 Van Horne St., TORONTO, Ontario



If any advertisement interests you, tear it out now and place with letters to be answered.



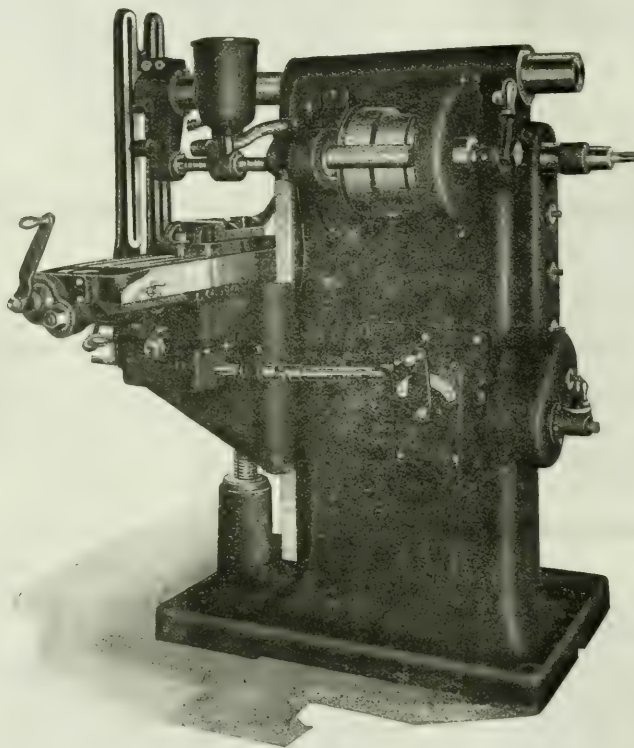
Adv't. No. 1

Miller Series

First let us tell you the various sizes of Millers we manufacture:—

No. 2 Plain	-	27" x 19" x 7½"	No. 2 Universal	-	25" x 18" x 8"
No. 3 Plain	-	34" x 20" x 10"	No. 3 Universal	-	34" x 19" x 10"

—WITH ALL GEAR FEEDS—



We leave you to study this photograph—and next issue will describe various reasons why our Millers are to be found in most up-to-date Machine Shops and Tool Rooms.

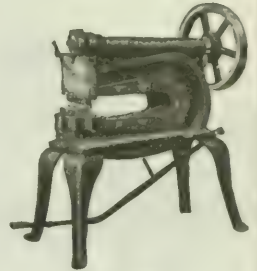
The Ford-Smith Machine Company, Limited
 HAMILTON ONTARIO CANADA

Sheet Metal Working Machinery of Any Description

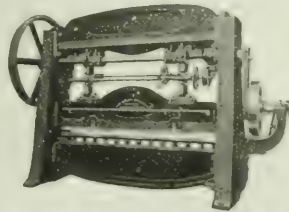


No. 2—G.A. Press

B.B. Presses for
Quality, Efficiency,
Durability, Speed,
Accurate Production.

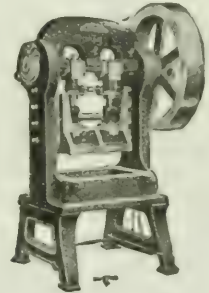


No. 126
Deep Throat Power Punch

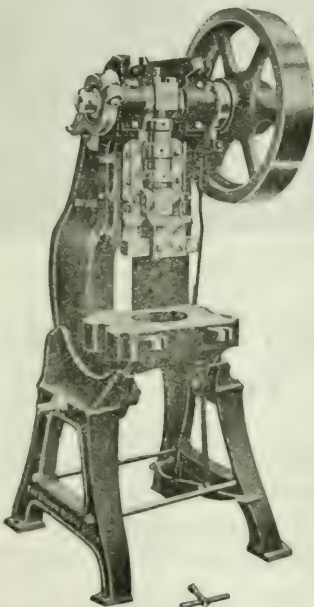


No. 500—Power Brake or Press

B.B. Presses embody special
features for minimizing main-
tenance cost of both machines
and tools.



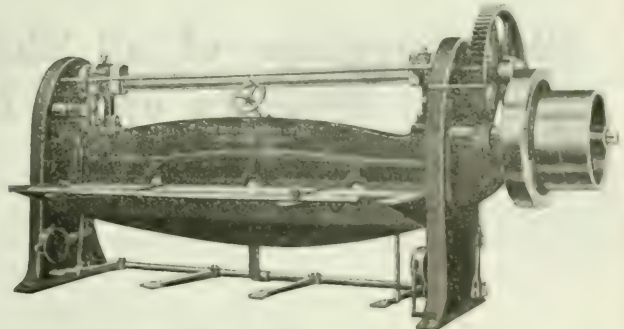
No. 20 1/2—Power Press



No. 200—Power Press

The Brown, Boggs Company, Limited
HAMILTON ONTARIO

MANUFACTURERS OF
Tinsmiths' Heavy Sheet Metal Working Machinery



No. 960—Overhead Shear

If any advertisement interests you, tear it out now and place with letters to be answered.

Nova Scotia Steel & Coal Company *Limited*

New Glasgow, Nova Scotia, Canada



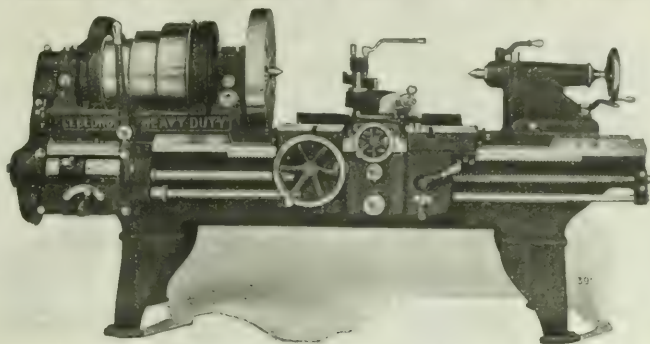
RUDDER FOR SS. "LUX." WEIGHT 9 TONS, LENGTH 42 FEET

Ship Forgings of all Shapes, Sizes and Weights up to 75 Tons

We manufacture, of Fluid Compressed Steel, forgings entering into the construction and equipment of steel vessels up to and including the largest building or afloat, and embracing Rudder Frames—sectional or one piece, also Rudders complete; Stern Posts and Stern Brackets for single, Twin and Triple Screw Ships, Rudder Heads, Boat Davits, Derricks, etc.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

LEBLOND HEAVY DUTY LATHES



Are lathes built for a definite service—And this a class of Production to which only LeBlond Heavy Duty Lathes are adapted.

There's a reason—

Hardened Spindle Bearings—

One-piece, box section, aprons—

Patent Compensating Vee Bed Design—

Double Friction Back Gears—

and LeBlond Workmanship *do add to the continuous productive life of a lathe.*

The R. K. LeBlond Machine Tool Co.

Cincinnati, Ohio, U. S. A.

Agents in Principal Cities

Two Cuts at One Time

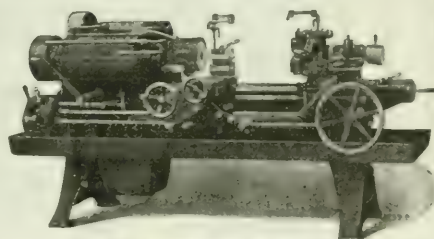
The ability to face, undercut or neck with the square turret while boring or turning with the hollow-hexagon turret contributes largely to the time-saving and economical output of the

Universal Hollow-Hexagon Turret Lathes

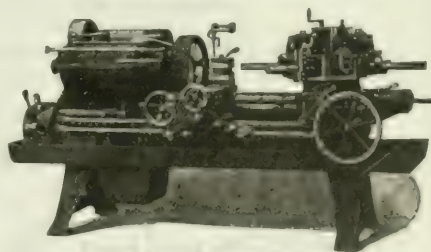
Separate feed shafts, each with ten individual feeds, operate the carriage and turret saddle independently, and provide the exact feed required for each.

And to this great advantage are added the other essentials for rapid and accurate production—excess power, extreme rigidity, great adaptability, and a power rapid traverse that saves time and conserves the energy of the operator.

Without obligation, ask us to show the saving on one of your typical jobs. Send blueprints with rough and finished samples.



No. 2-A—With "Bar Equipment."



No. 2-A—With "Chucking Equipment."

THE WARNER & SWASEY CO., Cleveland, Ohio, U.S.A.

Canadian Agents: A. R. Williams Machinery Company, St. John, Toronto, Winnipeg, Vancouver; Williams & Wilson, Montreal; Benson Bros., Sydney and Melbourne, Australia; A. Asher Smith, Sydney, Australia

If any advertisement interests you, tear it out now and place with letters to be answered.

ECONOMY

UNIFORMITY



AMACOL

ATLAS

TENAXAS

MASCOT

TIN TOUGHENED



W. E. W. BABBITT

HAVE A WORLD-WIDE REPUTATION FOR UNIFORMITY

ATLAS Alloys are scientific products—the result of much patient research and long years of experience. They are manufactured under the most modern scientific conditions, thereby eliminating any element of chance in their composition and ensuring a standard maintenance of quality and uniformity.

ATLAS Brands are not alloys that *sometimes* give satisfaction. They are alloys that can be implicitly relied upon *always*. They are alloys with our *prestige* and *reputation* always behind them.

DO not let prejudice stand between *you* and *profit*. You can obtain the *maximum efficiency* from your plant at a *minimum of cost* by using ATLAS BABBITTs.

THERE IS AN ATLAS BRAND TO MEET ANY NEED

NO SHOCK TOO SEVERE

NO WEIGHT TOO HEAVY

NO SPEED TOO GREAT

Atlas Metal and Alloys Company of Canada, Limited

MONTREAL

Sales Agents:

The Canadian B. K. Morton Co., Limited

MONTREAL

49 Common Street

Phone M. 3206

TORONTO

86 Richmond Street East

Phones M. 1472-1473

**TEXTILE BELTING
and PACKINGS**

**J. R. BAXTER
& COMPANY LIMITED,
MONTREAL.**

**HIGH TWIST SPEED
DRILLS**

and GENERAL MACHINERY SUPPLIES

For Export and Import—

Iron — Steel — Metals

Machinery, Raw Products and Manufactured Goods

A. G. KIDSTON & CO.

with offices in

LONDON GLASGOW MONTREAL NEW YORK
AUSTRALIA NEW ZEALAND SOUTH AFRICA

and connections all over the civilized world, have exceptional advantages for the marketing of Canadian and other products.

Enquiries invited and promptly handled.

Manager for Canada and U.S.A.:

C. E. GAUSDEN, 17 ST. JOHN STREET, MONTREAL

Cables: "KIDCO," Montreal

Increased Production Means Increased Profits



Large Millers
for large work
— STEPTOE
MILLERS
for small work.



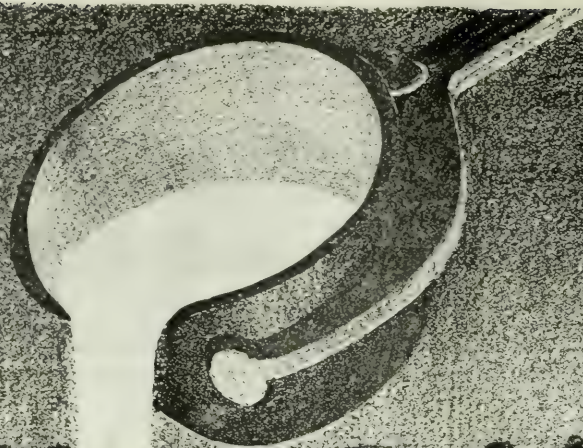
Large Planers
for large work
— STEPTOE
SHAPERS
for small work.



Will result in increased production; less money
invested in machinery, and increased profit.

THE JOHN STEPTOE COMPANY
CUMMINSVILLE, CINCINNATI, OHIO, U.S.A.

If any advertisement interests you, tear it out now and place with letters to be answered.



WOLFRAM

Some Facts About Tungsten

The qualities of heat resistance, uniformity, and endurance—essential to a standard High Speed Steel—are admirably well supplied by Tungsten.

As high as 18% of Tungsten can be used beneficially in tool steel; this is not true of any other alloy. The consequent heat resisting powers of the steel are remarkable. Carbon Steel without Tungsten will harden at 1400 deg. F., and will coarsen at 1500 deg. The same steel containing 18% Tungsten will not coarsen even at 2350 deg.

Tungsten, the most stable alloy, supplies infinite endurance. Repeated redressing, hardening and heavy usage do not affect the cutting power of the steel.

WOLFRAM

The Standard Tungsten High Speed Steel is of uniform high quality, and may be worked down to the last ounce without variation.

VULCAN CRUCIBLE STEEL CO.

ALIQUIPPA

ESTABLISHED 1900

PA. U.S.A.

Represented in Canada by Messrs. NORTON, CALLARD & COMPANY
MONTREAL, QUEBEC

ESTABLISHED 1870

W^M. ATKINS & C^O., L^{TD}.

TRADE MARK



Reliance Steel Works
SHEFFIELD, ENG.

TRADE MARK



TRADE MARK

of the Famous

“WACO”

Brand

High Speed Steel and Twist Drills

“DOUBLE WACO” Quality

Specially Adapted for all kinds of
MUNITION WORK

“Turtle” Brand
High Class Tool Steel, Files, etc.
of all descriptions.

For particulars apply to our
Sole Representatives for Canada

GEO. A. MARSHALL & CO.

70 Lombard Street Toronto, Ontario

If any advertisement interests you, tear it out now and place with letters to be answered.

Electrite- Uranium



Several factors combine to make this high speed steel a triumph of the steel-maker's art:

Electric Furnaces—entirely infallible, automatically regulated, delivering the same results time after time.

Uranium—this rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Company Latrobe, Penn.

Sales Offices:

105 Broadway, New York, N.Y.
Washington & Green Sts., Chicago,
Ill.
40 Central St., Boston, Mass.
149 California St., San Francisco.

First National Bank Bldg.,
Pittsburgh, Pa.
664 Spitzer Bldg., Toledo, Ohio.
2230-2240 E. Ninth St., Cleveland,
Ohio.
536 1st Ave. So., Seattle, Wash.

2802 Union Central Bldg.,
Cincinnati, Ohio.
1105 Conover Bldg., Dayton, Ohio.
198 Cleveland Avenue, Buffalo, N.Y.
514 No. 3rd St., St. Louis, Mo.

Commercial Trust Bldg.,
Philadelphia, Pa.
1001 Ford Bldg.,
Detroit, Mich.
Oppenheim Bldg., St. Paul.

Ferro-Uranium

*The Latest Discovery in Alloys
for Efficient*

HIGH-SPEED ——— AND OTHER ——— STEELS OF QUALITY

It insures tools that
STAND UP ON THE JOB

Largest Producers in the World of URANIUM

WRITE US FOR PARTICULARS

STANDARD ALLOYS COMPANY
Forbes and Meyran Aves. -:- Pittsburgh, Pa.

If any advertisement interests you, tear it out now and place with letters to be answered.

One of the
Steels of the Century
Centurion High-Speed

Made from the **BEST** Materials
Iron, Tungsten, Chrome, Vanadium

Melted by the **BEST** Process
The Crucible Furnace Method

Handled by the **BEST** Workmen
Melters, Forgemen, Annealers, Metallurgists

CONSEQUENTLY
Will do the **BEST** Work

Quality

Delivery

Service

We have a catalog waiting for you. Write for it.

THE CENTURY STEEL CO. OF AMERICA

MANUFACTURERS OF HIGH-GRADE CRUCIBLE STEELS

Works :
**POUGHKEEPSIE,
N.Y.**

Sales Offices :
**120 BROADWAY,
NEW YORK**



"Red Cut Superior"

HIGH SPEED STEEL

YOU have thought of many qualities you would like to have in High Speed Steel Tools—such as cutting edges with long life, freedom from brittleness, great reserve strength and toughness to resist shocks and strains, tools that would not require special heat treatment, tools that would take deep roughing cuts or fine smooth finishing cuts, and in addition, could be worked at higher speeds than you ever dreamed of. All these virtues and many more are contained in "Red Cut Superior", a First Quality High Speed Steel. Furnished in Annealed Bar Stock, Discs and Treated Tool Holder Bits.

Send for folder.

Are your tools made of **Red Cut** ?

VANADIUM-ALLOYS STEEL CO.

Pittsburgh, Penna. Works at Latrobe, Pa.

If any advertisement interests you, tear it out now and place with letters to be answered.

IF YOU WANT THE

BEST BASE PLUGS, BUY BANFIELD'S

Have in stock for immediate shipment either threaded or bevel Plugs for 4.5", 5" and 6" High Explosive Shells. These are shipped subject to acceptance of Government inspector at your plant.

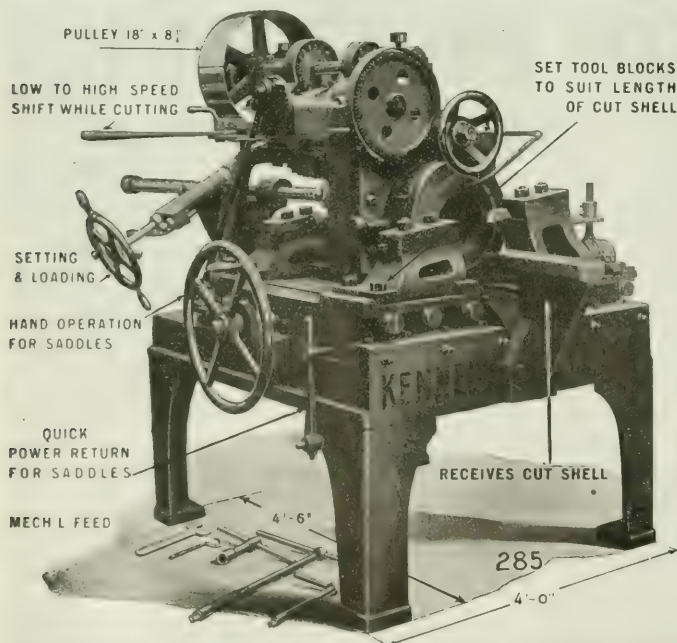
Capacity, 3,000 per day.

Write for prices.

EDWIN J. BANFIELD

STAIR BLDG. .: TORONTO, ONT.

Manufacturer of Plug Milling Machines for above size shells. Prices and deliveries on application.



CUTTING-OFF MACHINES

Cuts both ends at once

except 8 in. and 9 in. sizes which
cut one end only

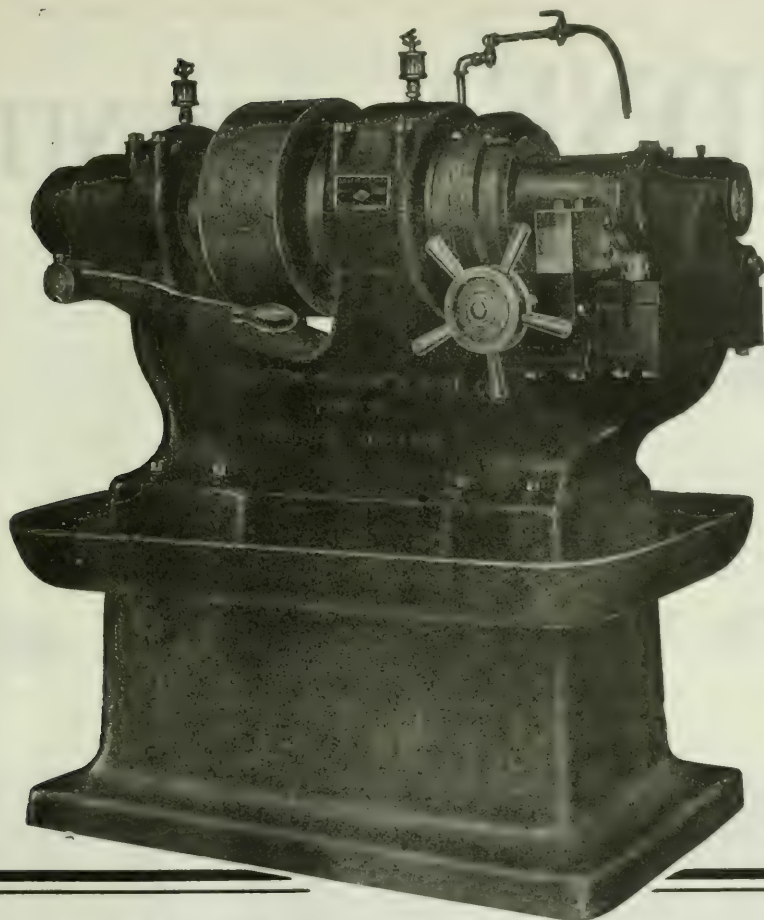
Forgings load in one end and dis-
charge out the other when cut

A Girl can operate it

New quick power return for saddles

DELIVERIES REASONABLE

The
Wm. Kennedy & Sons,
Limited
Owen Sound



Just Now—

we have two 4.5 machines ready for immediate delivery

THIS Band Turning Machine, by its ability to perform efficiently month after month under exceptional production strains, has proved its worth to munition makers. It is being used by many Canadian munition plants, where it is giving absolute satisfaction.

▲ glance over some of the features will interest you.

Integral (en bloc) construction assures

perfect rigidity, permanent accuracy and desirable compactness.

Chucking with spring collet chuck insures accurate and speedy chucking.

Graduated feed dial, two cutting tools, and ample belt power insure output of accurate work in least possible time.

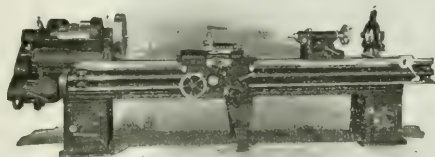
Machines are also built for 15, 18, 60-pdr. and 6" shells.

ROELOFSON MACHINE & TOOL COMPANY, LIMITED

Head Offices: 1501 Royal Bank Bldg., Toronto, Canada. Works: Galt, Canada

If any advertisement interests you, tear it out now and place with letters to be answered.

SIDNEY SERENITY



tion tells why. Bulletin 30 contains the story.
Canadian Agents:

Foss & Hill Machinery Co.
Montreal, Que.

H. W. Petrie, Limited
Toronto, Ont.

The Sidney Tool Company
Sidney, Ohio, U.S.A.



We hear much of Nations standing "serene in the face of danger." But what about the machines that stand serene in the face of terrific service demanded by the abnormal conditions of war, and which must be met?

It takes correct design, the best materials, rigidity, convenience and **INBUILT-SERVICE** to enable Lathes to "stand up" with serenity under the driving and crowding imposed by war conditions—and **SIDNEYS** stand the gaff. A study of their construction tells why. Write us—or get in immediate touch with one of our

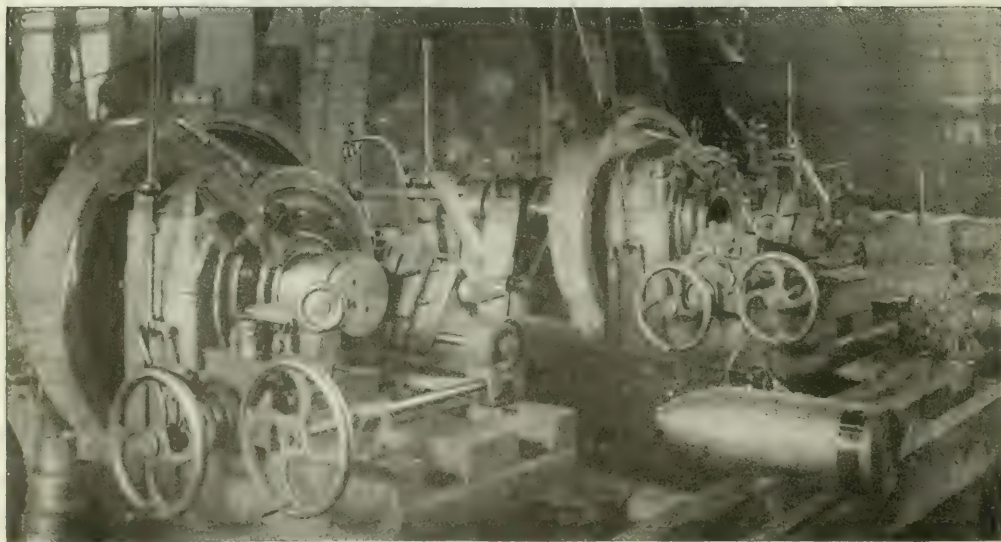


Photo shows two of our Hand Turning Machines in one of the largest shell shops in Canada.

These machines are built for turning hands on 8", 9.2" and 12" shells. They are giving perfect satisfaction in several of the largest 9.2" shops in Canada. Let us put you in touch with some of them. Write for full particulars and price.

Bennett Ave.

Warden King Limited

Maisonneuve, P.Q.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

TWO HUNDRED POUNDS

TWO HUNDRED POUNDS MORE THAN THE
CIRCULAR WEIGHT; THAT'S WHAT
THE LATEST CISCOS WEIGH.

A 14	by	6	weighs	1700	pounds	net	instead	of	1500
A 16	"	6	"	2550	"	"	"	"	2350
A 18	"	8	"	3700	"	"	"	"	3500

and EVERY POUND COUNTS because EVERY POUND DOES its ALLOTTED work.

Cisco Lathes are not just sheer heavy, a bulky mass of iron.

Their design is so CAREFULLY studied that there is NO WASTE material.

*DID YOU EVER SEE A BOY OPERATE ONE? HE CAN.
DID YOU EVER SEE A CISCO LATHE USER'S REPAIR BILLS? NOT OFTEN.
DID YOU EVER RUN A MORE SATISFACTORY LATHE? MIGHTY SELDOM.*

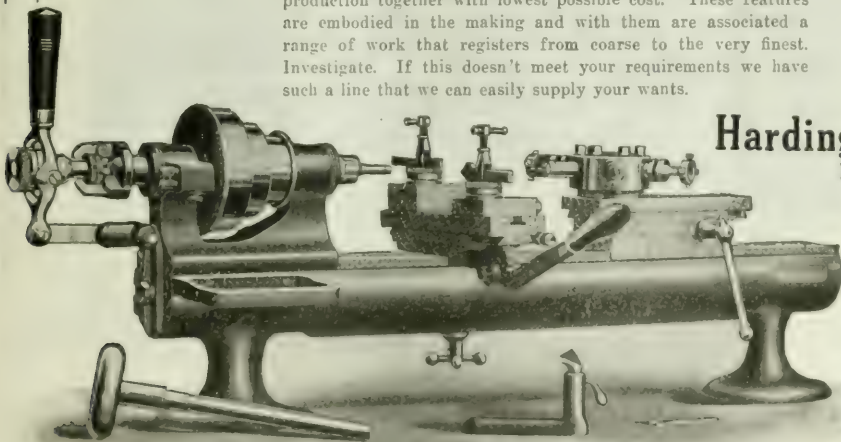
**That's Why They Buy
CISCO—THE LATHE WITH THE PULL**

Sold extensively and exclusively in Canada by
The A.R. Williams Machinery Co., Ltd.

MADE IN CINCINNATI, U.S.A., BY
The Cincinnati Iron and Steel Co.
14, 16, 18 24 Sizes

If it is a Question of Efficiency

There are lathes that will give you all grades of efficiency. But we interpret efficiency to mean highest speed and quality of production together with lowest possible cost. These features are embodied in the making and with them are associated a range of work that registers from coarse to the very finest. Investigate. If this doesn't meet your requirements we have such a line that we can easily supply your wants.

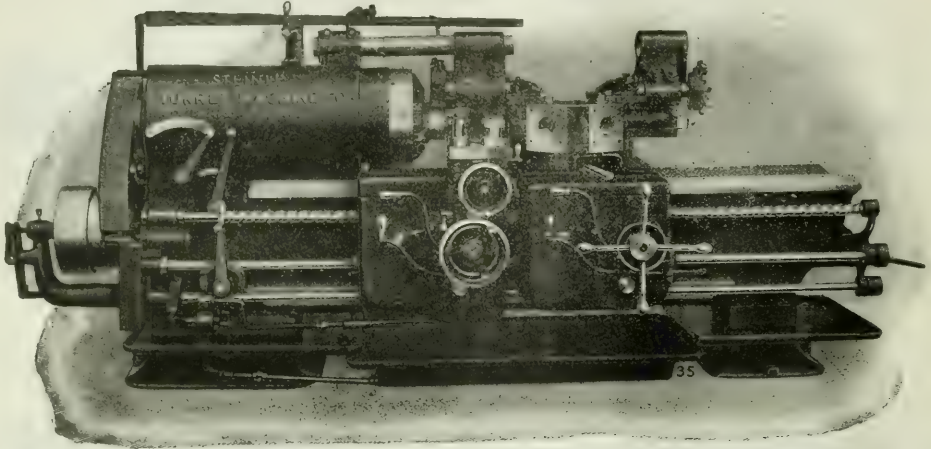


Hardinge Bros.
Inc.

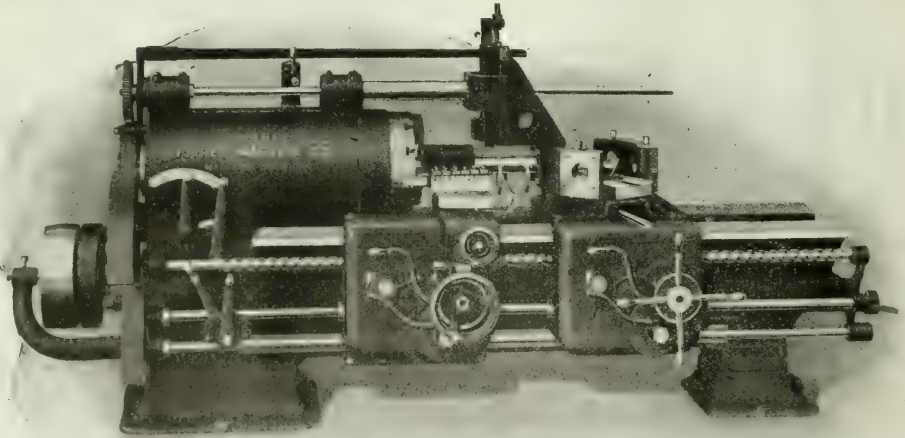
1770 Berteau
Avenue,
CHICAGO,
ILL., U.S.A.

A GENERAL PURPOSE HEAVY DUTY TURRET LATHE

Adapted to a Wide Range of Work



Standard Machine Equipped with Tools for Munition Work



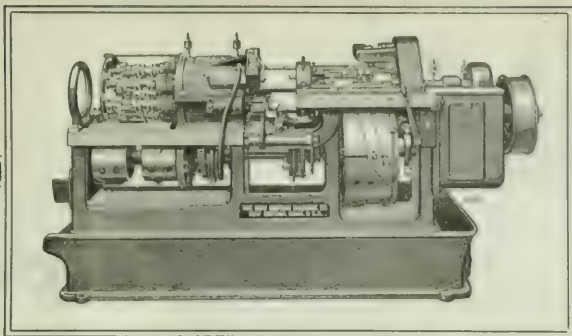
Same Machine Tooled Up for Manufacturing Piston Rings

WRITE FOR INFORMATION

STEINLE TURRET MACHINE COMPANY

MADISON, WISCONSIN, U.S.A.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.



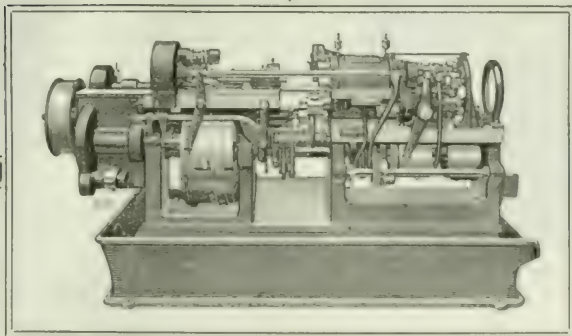
NEW BRITAIN SIX-SPINDLE AUTOMATICS

*"The Last Word
in
Screw Machines"*

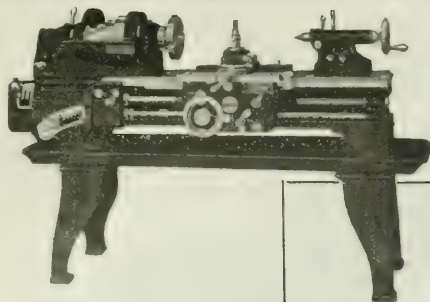


For complete information address:

THE NEW BRITAIN MACHINE COMPANY
New Britain, Conn., U.S.A.



If any advertisement interests you, tear it out now and place it with letters to the editor.



37 Feeds

By the feeds and speed is the value of the machine judged. 37 feeds is the range of this machine and its speed is decided in two ways. The specially designed tumbler gears insure absolute minimum of wear, there being no clashing when the gears engage. This allows for greater speed. The absolute lack of all superfluous mechanism is another feature that promotes speed. Sizes 12" to 14" with 4', 5' or 6' bed. The other features are amply shown and illustrated on our bulletin which is waiting for your inquiry.

Mulliner-Enlund Tool Co., Inc.
Syracuse, N.Y. U.S.A.

Canadian Representatives:
H. W. PETRIE, TORONTO FOSS & HILL, MONTREAL

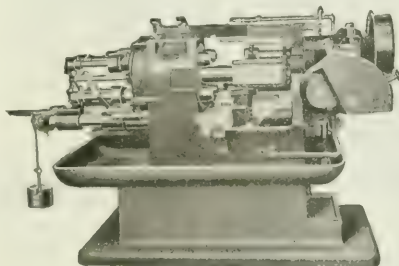
The PROOF of SATISFACTION

is found in the *continued use of* and the *increased demand for*

GRIDLEY MULTIPLE SPINDLE AUTOMATIC SCREW MACHINES

Years of satisfactory service uphold the reputation of Gridley Automatics for DURABILITY, ACCURACY and RAPID PRODUCTION.

Well-planned designing and careful workmanship have guaranteed these qualities.



GRIDLEY MULTIPLE SPINDLE AUTOMATIC
Chuck capacity up to 2 $\frac{5}{8}$ in. — Length of feed 7 in.

Gridley Multiple Spindle Machines handle work up to 2 $\frac{5}{8}$ " chuck capacity. Single Spindle Machines up to 5" bars or single-piece chucking.

Descriptive bulletins, or quotations on your blueprints, will be sent without obligation to you.

THE NATIONAL ACME COMPANY

WINDSOR, VERMONT

GENERAL OFFICES, CLEVELAND, O.

CANADIAN SCREW PLANT, MONTREAL, P.Q.

BRANCH OFFICES

NEW YORK BOSTON CHICAGO DETROIT ATLANTA SAN FRANCISCO
Warehouses New York and Chicago Representatives in Foreign Countries

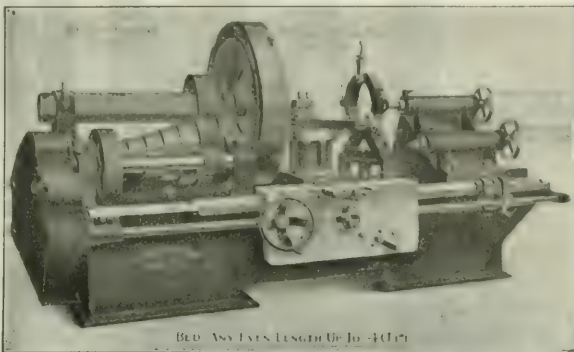
Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont,
and Acme Automatics, Threading Dies, and Screw Machine
Products at Cleveland, Ohio.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

One Ship- building Plant

wrote to six differ-
ent Lathe-Builders

and bought McCabe's "2-in-1"
Double-spindle Lathe—on a
30-ft. bed—because it was
"different" and built especi-
ally for such a wide range of
work.



McCABE'S "2-in-1" Double-Spindle Lathe—26-48 inch Swing
As a 48 inch Triple-Geared Lathe

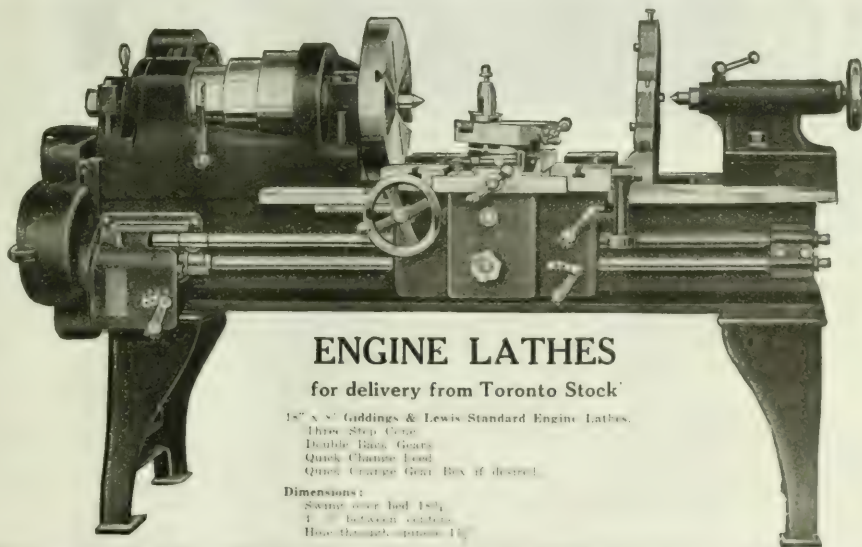
What other big Lathe can you get, and have full use of your Lathe, whether you have
big or small work?

What Lathe Manufacturers except McCabe could make such a low price possible?
No other Lathe Builder turns out 48 inch Lathes in such big lots at a time, making
the parts all duplicate and interchangeable.

And in addition to the 48 inch Triple-geared Lathe, the 2 inch is the "Lathe plus"
because McCabe offers you at no extra cost.

Full BEE service, convenience and capacity all described in Latest Bulletins.

J. J. McCABE, 149 BROADWAY, NEW YORK



ENGINE LATHES

for delivery from Toronto Stock

18" x 4' Addings & Lewis Standard Engine Lathes.

Three-Step Gear
Double Back Gears
Quick Change Lead
Quick Change Gear Box if desired.

Dimensions:

Swing over bed 18"
4' between centers
How through, optional 14"

These are strongly built, accurate machines. Will give equal satisfaction in tool-room or shop.
The following extras can be furnished if desired: Taper, Relieving or Draw-in attachment, Waving attach-
ment, Hexagon turret on carriage, Pan pump and piping.

Write for full specifications and prices.

Garlock-Walker Machinery Co., Ltd., 32 FRONT ST. WEST, Telephone MAIN 5346 Toronto

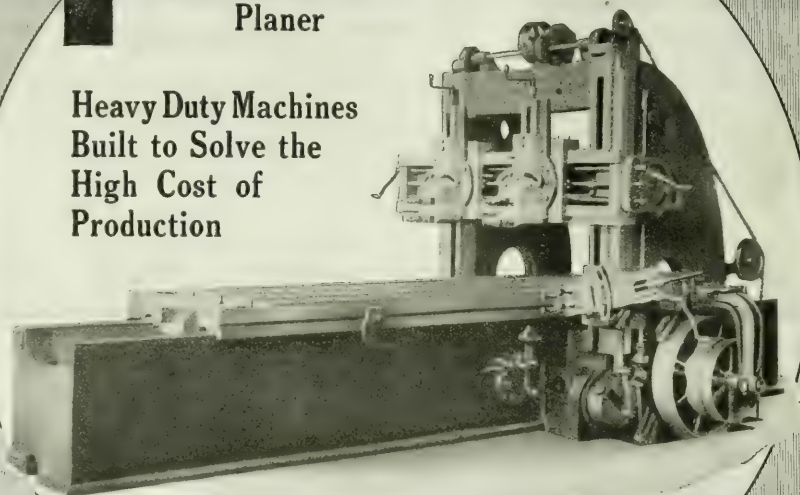
If any advertisement interests you, tear it out now and place with letters to be answered.

HAMILTON

PLANERS

**Hamilton 36" x 36"
Planer**

**Heavy Duty Machines
Built to Solve the
High Cost of
Production**



W EIGHT, RIGIDITY, DIMENSIONS and POWER—these are the combination of assets that give exceptional productive ability to "HAMILTON" PLANERS. The installation of the "HAMILTON" strikes a crushing blow at the High Cost of Production. They do big work fast and accurately. Sizes from 24" x 24" to 54" x 54".

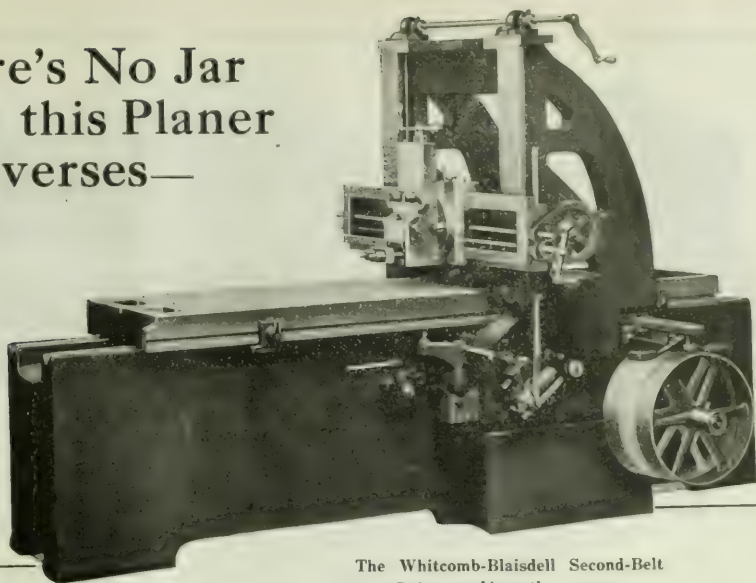
Our bulletin will tell you all about this planer. Give us your address.

The Hamilton Machine Tool Company, Hamilton, Ohio
H. W. PETRIE, LIMITED, TORONTO, Sole Agents for Ontario.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

There's No Jar When this Planer Reverses—

Whitcomb-
Blaisdell 24-
inch Planer
with Second-
Belt Drive.



The Whitcomb-Blaisdell Second-Belt
Drive cushions the reverse

The "Second-Belt" replaces the usual bull-wheel and train of high speed gears.

All the shocks and jars of rapid-running gears are entirely eliminated. The Second-Belt, while driving positively, imparts to the table a smooth, easy action.

It secures greater accuracy and better finish. Furthermore, it prolongs the life of the entire machine.

The absence of shock at the end of stroke—the "cushioning" of the reverse—permits the Whitcomb-Blaisdell to run at extremely high table-speeds.

Thus the Second-Belt Drive secures speed, smoothness, and accuracy in cutting.

There are many details of construction in the Whitcomb-Blaisdell details that mean PRODUCTION—that you should know

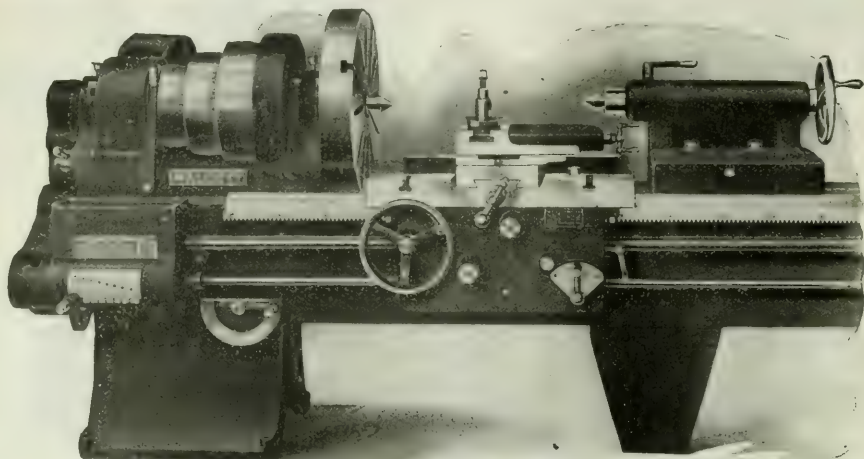
Write for the Whitcomb Blaisdell Planer Book.

LATHES
From 14" to 30"
SWING

WHITCOMB-BLAISDELL
MACHINE TOOL CO.
WORCESTER, MASS., U.S.A.

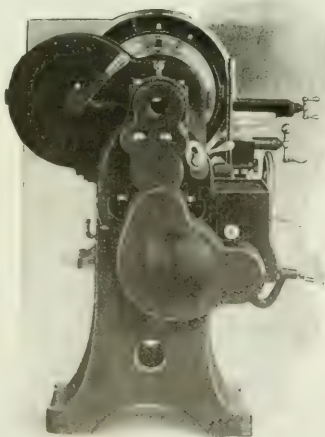
PLANERS
From 17" to 48"
WIDE

If any advertisement interests you, tear it out now and place with letters to be answered.



Walcott Lathes—Time Tested

*It did not take 36 years
to establish a reputation,
but you can benefit by
that experience.*



YOU can subject this 26" Engine Lathe to any test and at the outcome you will find that 36 years of lathe building have enabled us to present a machine that answers the most rigid requirements.

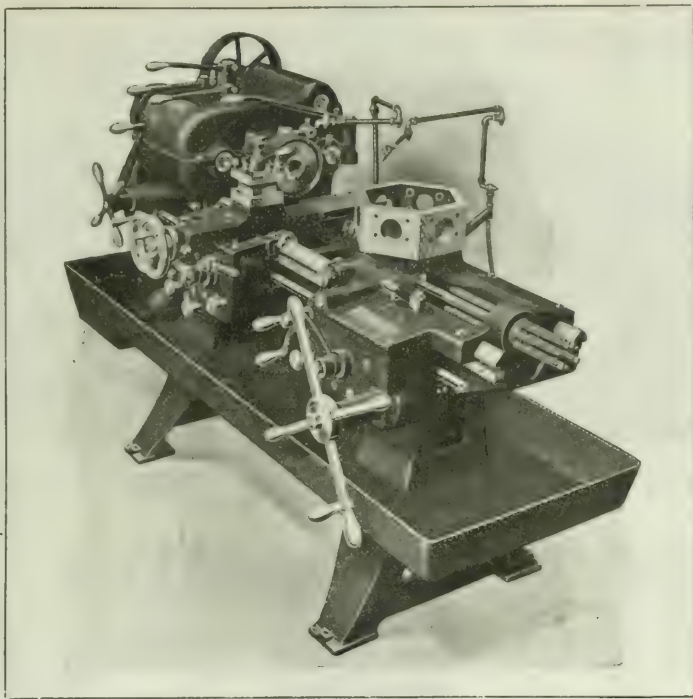
Reinforced and strengthened at the points of stress, this machine includes such features as: double apron plate, drop forged gear in apron, rigid compound rest, back gear arm reinforced by one-piece gear guard and headstock, not a single tooth exposed, feed gears run in oil, large frontway on bed, rod and screw feed, and quick change gear box.

Made in 14", 16", 18", 20", 26" and 28" sizes.

Our experience and co-operation are entirely at your disposal. Write us.

Walcott Lathe Company

Calhoun Street, Jackson, Mich.



RIGIDITY

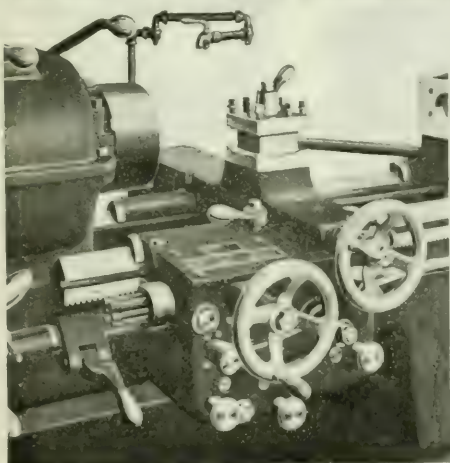
Another secret behind rapid production is the rigidity of the tool and work support. It is the further claim of the designer that this is the most rigid machine of its class and size. The overhand of the spindle nose is unusually short. The entire carriage unit is built to make an extremely rigid support for the cutting tool.

FEED RANGE

FEEDS PER REVOLUTION											
0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009	0.010	0.012	0.015
0.018	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.060	0.075	0.090	0.100
0.120	0.150	0.180	0.200	0.250	0.300	0.350	0.400	0.450	0.500	0.600	0.750
0.900	1.000	1.200	1.500	1.800	2.000	2.500	3.000	3.500	4.000	4.500	5.000

This covers the requirements from turning soft cast iron and up to and including wide turning in steel. Furthermore the feed changes are reasonable in the space which is ideal.

Please note, however, that this is only one of the several features which...



Square Turret, Cross Slide and Carriage.

Foster Machine Company
ELKHART, INDIANA

If any advertisement interests you, tear it out now and place it in the box to be answered.



The House of Matthews

MATTHEWS of Pittsburgh makes but one class of goods—marking devices—and on the word of the men who use them they make the best devices the market affords.

Matthews has been in business 67 years. The Matthews factory is the largest of its kind in this country, fully equipped to make every marking device of which any industry has need.

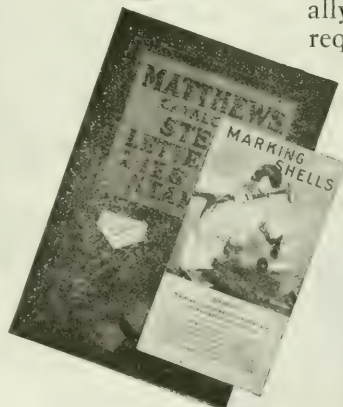


MATTHEWS' policy is to make and hold customers through quality of product and prompt, dependable service.

This is the combination Matthews offers you: steel stamps, letters, figures, etc., marking devices of any type—designed and made especially to meet your individual requirements, and delivered in the shortest possible time.

Write for copies of "Matthews' Catalogue of Steel Lettering Dies and Stamps"—the only complete catalogue of steel dies published—and "Marking Shells." Both for the asking.

Write now -- nothing to be gained by waiting.



If you agree with Matthews that "any product worth making is worth marking right," these booklets will prove profitable reading.

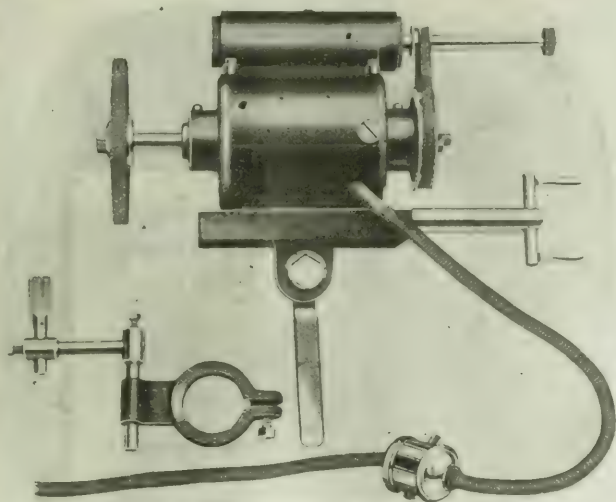
JAMES H. MATTHEWS & CO.

FORBES FIELD

67 Years in Business

PITTSBURGH, PA., U.S.A.

Distributors for Canada: CANADIAN FAIRBANKS-MORSE COMPANY, LTD., St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria.



ARO

The 30,000 revolutions per minute that this Aro grinder attains can only be maintained with least wear on the bearings and motor by perfectly balanced and proportionate construction of the mechanism.

The rigid construction, the armature, internal spindle pulleys and large emery wheels are dynamically balanced, preventing vibration. No end thrust or side play. These features contribute to the accuracy and durability for which the Aro is specially noted.

The motor and internal spindle are equipped with S. K. F. and "Norma" Ball Bearings.

An inquiry will receive intelligent attention.

R. E. T. Pringle, Limited

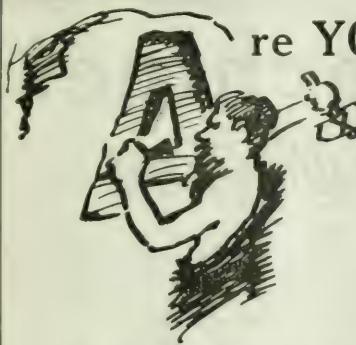
Manufacturers' Agents

OFFICES:

Tyrrell Bldg. 95 King St. East, Toronto
809 Unity Bldg., Montreal, Que.

3402 Osler Ave., Vancouver, B.C.
302 Donalds Block, Winnipeg, Man.

Are YOU Primitive in Your Methods?



Do you mark your various Tools, Rifle Parts, Timing Fuses, Shells, etc., in the Stone Age Manner?

If you wish to mark your name, trade, sizes or patent marks quickly, accurately and legibly on your various tools, purchase a

Martin

Low in price, simple in construction and extremely rigid, the "Martin" No. 6 Hand Marking Machine instantly appeals to the practical shop man. They give your products the distinction which comes only with clean, distinct and artistic impressions. Surely if you have marking of any kind to do it will pay you to investigate the "Martin" at once. Simply tell us what you require and we'll send full particulars by return mail. Write today to the



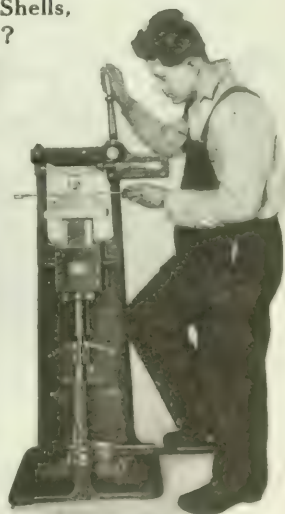
"MARKING MACHINE PEOPLE"

MARTIN MACHINE CO.

GREENFIELD, MASS., U.S.A.

Manufacturers of both Hand and Power Machines.

Canadian Representatives: THE CANADIAN FAIRBANKS MORSE CO., LIMITED, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria.



If any advertisement interests you, tear it out now and place with letters to be answered.



Grinding Planer Tools With Alundum Wheels

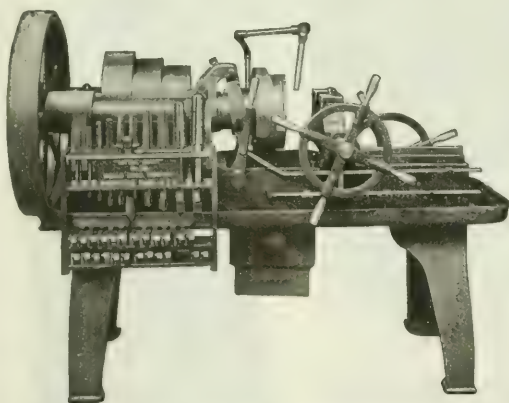
The wheel on the machine shown is a 24-inch Vitriified Alundum, grain 30, grade O, running at a speed of 900 r.p.m. The wheel is in actual operation grinding tools 90 per cent. of the time, and under this service wheels are lasting 4 to 5 months. Equally good results are being made on other grinding operations.

NORTON COMPANY
WORCESTER, MASS.

ELECTRIC FURNACE PLANTS:
NIAGARA FALLS, N.Y., CHIPPAWA, ONT.
Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B.; Winnipeg, Calgary, Saskatoon, Vancouver, Victoria; F. H. Andrews & Son, Quebec, Que.

Threading Machines

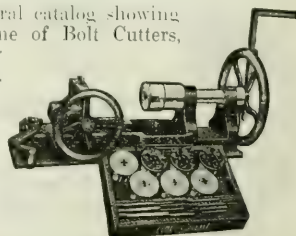
Little Giant



threading machines are free from time-consuming complications. Any shop employee can set them up in a few minutes. They are very easily operated. Any length of thread can be cut with the power machines, as they are fitted with hollow spindles.

The Little Giant line includes a complete range from the power machines with Automatic Opening Die Heads to the small bench machines with Solid Die Heads.

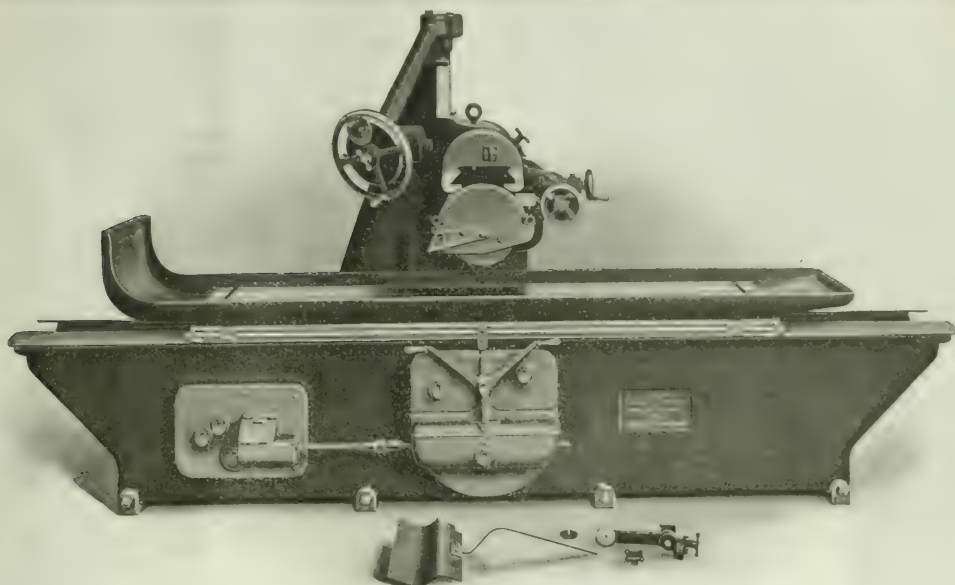
Send for general catalog showing our complete line of Bolt Cutters, Taps, Dies, Screw Plates, Gages, Reamers, etc.



Wells Brothers Co. of Canada, Limited
GALT, ONTARIO

Sales Agents: THE CANADIAN FAIRBANKS-MORSE COMPANY, LIMITED.
Montreal Toronto Vancouver Winnipeg St. John, Calgary.

The New Norton



Features That Mean Production

The Wide Wheel

For the ordinary line of work the wheel is of 6" face. No automatic feed of the wheel is provided. But a hand traverse so locates the grinding wheel that the full width of the wheel face is utilized,—thereby production.

The wheel head can be raised to give a distance of 17" between the surface of the table and a 14" diameter wheel, thus making provision for use of magnetic chuck or supplementary table.

The Entire Working Surface

of the table can be ground in place. On all tables this is 15" wide and 6, 8, 10, 12' and 14' long, depending on the length of machine.

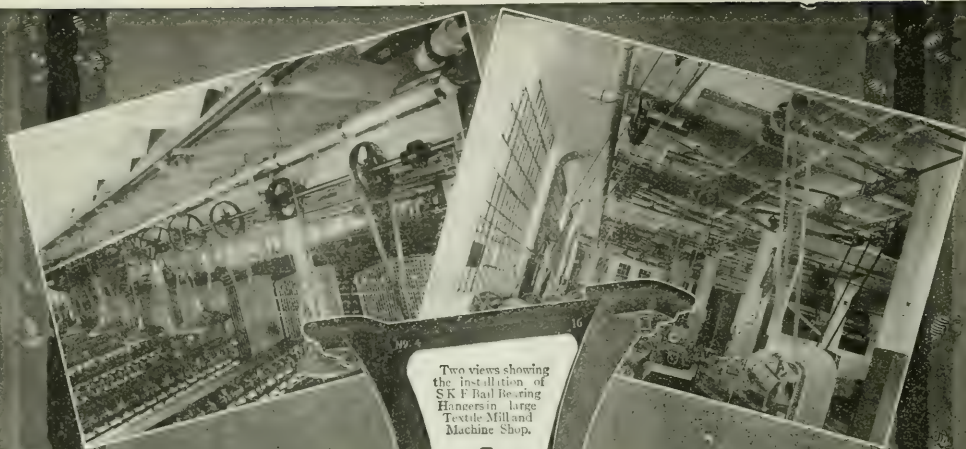
In addition to grinding all kinds of plane surfaces this Norton Grinding Machine can be used for grinding a variety of shape surfaces—for which a special forming attachment is used to true the wheel face to produce the shape required.

Norton Grinding Co., Worcester, Mass.

Canadian Selling Agents: The Canadian Fairbanks-Morse Co.

St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

Note the Open Side



Two views showing
the installation of
S K F Ball Bearing
Hangers in large
Textile Mill and
Machine Shop.

RELIABILITY

What is more essential than reliable power transmission? A hot box can tie up production for hours, till repairs are made.

Are you still using plain bearings on your lineshafting? If so, then you know the countless troubles that are ahead of you. Hot boxes, worn bearings, rebabbiting, continuous oiling—all of these are trouble-makers and mean delay.

This delay can be eliminated. You can put an end to all trouble by using S K F Self-Aligning Ball Bearing Hangers. S K F Ball Bearings do not wear down; they do not heat. They are positive preventers of trouble.

Send for information.

Canadian SKF Company, Limited
TORONTO, ONTARIO

Sales Agents for SKF Transmission Bearings:

The Canadian Fairbanks-Morse Co., Limited

St. John Quebec Montreal Ottawa Toronto Hamilton Windsor
Winnipeg Saskatoon Calgary Vancouver Victoria

SKF BALL BEARINGS

REED-PRENTICE COMPANY

WORCESTER MASS. U.S.A.



THIS 21-INCH EXTRA HEAVY UPRIGHT DRILL

WOULD PLEASE YOU
BECAUSE

IT IS BUILT WELL
IT LOOKS WELL
IT ACTS WELL

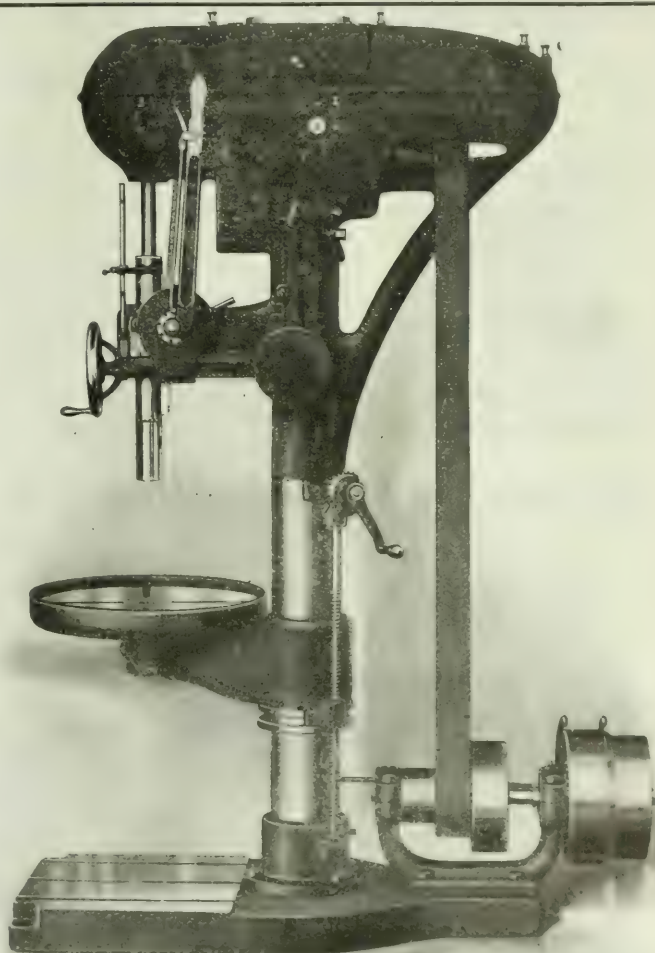
ALL DRIVING SHAFTS RUN
ON BALL BEARINGS. A
VERY HIGH PERCENTAGE
OF THE POWER APPLIED
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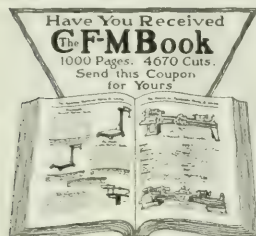


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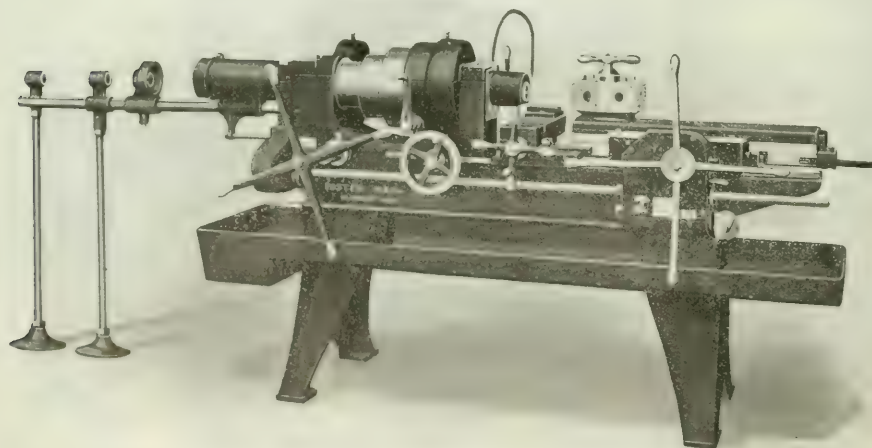
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Utilizing a Pre-War Factory for Shell Machining and Forging

Staff Article

The plant illustrated and described in the accompanying article is an interesting example of the manner in which the manufacture of shells has brought into use many previously discarded plants. Formerly engaged in an entirely different branch of industry, the output of munitions manufacture has witnessed a revival of activity beyond that of former times.

WHILE lesser in degree but not in effectiveness, the numerous Canadian munition plants and their output form an interesting subject of comparison with the controlled establishments of Great Britain. There are some specially built plants in this country, both as regards buildings and machinery, but their number is small, and their size little, compared with the National shell factories with which Britain is now dotted through the length and breadth of the land. The proximity to headquarters, the constant and wide control possible, and the immense industrial resources available for introducing improvements and changes desirable, are features which have distinguished home as compared with Colonial practice, with corresponding differences in many of the plants and methods in use.

Plant and Product

The plant described in this article is housed in a building which were erected some years before the war and formed a branch establishment of an agricultural implement concern but had been idle for some considerable time when conditions rendered them desirable for use as a shell factory. While lacking in occasional refinements found in some of the highly specialized plants, considerable success has attended the efforts of the management, the production of 6 in. forgings having been successfully carried out on a scale of considerable magnitude, in addition to the machining of 4.5 in. high explosive shells from blanks supplied. The buildings, as will be noticed from the accompanying illustrations are of the single floor, saw tooth type,

and have undergone little if any change from their original condition, the principal item being the provision of roof housings above the hydraulic forging presses and hinged sections on the roof for ventilation in hot weather. The familiarity of our readers with shell production renders interesting an interesting brief resume of the work.

4.5 in. Shells

As mentioned above, the 4.5 in. shell forgings are shipped in, the receiving track being immediately alongside the preliminary operations department, so that the material is unloaded directly on to the floor beside the machine which performs the first operation, i.e., cutting-off the open end to length measured from the bottom inside. This is done in a Williams machine with a single tool, following which a Hall cutting-off machine removes the excess metal on the base, leaving a centre tit of ample diameter to take the centre hole with a reasonable allowance for eccentricity in the forging. This arises from the fact that the shell is held by the outside while cutting-off the base, and is carried on an arbor when centering, so that any discrepancy in the shape of the forging is at once noticed when the centre hole is being drilled.

The centering machine is of the double motion type in which the work and the drill revolve in opposite directions, and is composed of an old lathe bed on which are mounted two brackets carrying the work arbor. Parallel with the arbor, and back of it is a bar, also carried in a couple of brackets and having its right hand end projecting so as to

form a suitable support for a swinging link and a small belt driven gear. The free end of the link carries the drill spindle, geared to the wheel on the bar, and moved back and forth by a hand lever hinged in the back bar and used also for swinging the link in and out of position similar to a chasing slide on a brass finisher's lathe.

Preliminary Machining

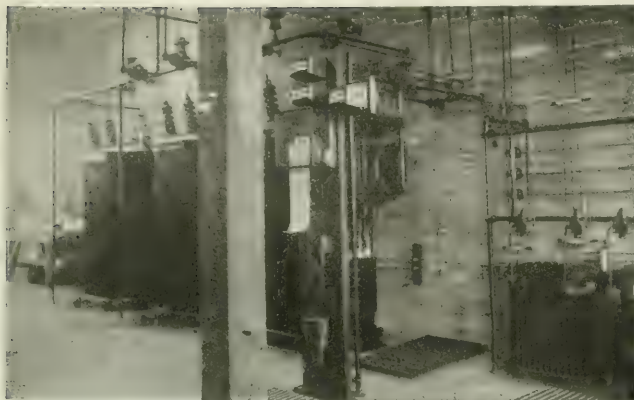
Two lathes, one Hepburn and one Simplex are engaged on rough turning. In this operation the work is driven by an automatic expanding arbor of the eccentric grooved type while the base end is supported in the tail centre. This is a plain turning operation and allows full advantage to be taken of the capacity of the machines.

The machining of the bore requires longer time per shell consequently a larger equipment is necessary, the machines used for this purpose being special shell boring machines of Canadian manufacture. Three Corbet and one Hepburn are in use, features of their design being a large diameter circular turret carried on a massive saddle sliding on a square gibbed bed with central rack and pinion traverse. Single pulley drive geared heads with Hannifin air operated chucks enable the work to be done and handled in an efficient manner. The actual operation itself is performed in the simplest manner, formed cutters of the spade type producing a perfectly smooth bore of the desired shape, while the nose is chamfered on the outside to facilitate the shaping of the nose to the required form.

Floor inspection by government offi-



VIEW OF STORAGE YARD WHERE 6 IN SHELL BULLETS AND FORGINGS ARE HANDLED



TRANSFORMER EQUIPMENT IN ELECTRIC SUB-STATION.

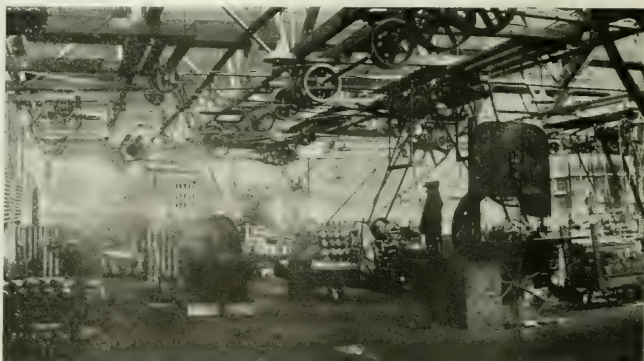
cials is done at this stage so that any rectification necessary can be done before nosing.

Nose-Forming and Finishing

A six-hole Tate-Jones oil fired furnace heats the shells for the nosing operation which is performed in the usual manner in a four-column hydraulic press. A split chuck of the hinged type holds the shell in position on the lower or moving table which forces the heated nose into a water cooled die which in turn forms the nose to the correct curve. Immediately on withdrawal from the die, the forgings are laid in a thick bed of flake mica which retards the rate of cooling so as to avoid any undue hardness in the metal, from which trouble might arise during the finishing of the nose.

The internal machining of the nose is done in conventional manner on two Rahn Larmon engine lathes with turret saddles, the operations being rough bore and chamfer, finish bore, blend interior profile with main bore, and finish fuse seat. These machines are fitted with

Harmifin air chucks, the pneumatic service being supplied by a 2-cylinder belt driven air compressor built by the



VIEW OF MACHINE SHOP FOR PRELIMINARY OPERATIONS ON 4.5 IN. SHELLS.

Hamilton Motor Works. The shell being chucked by the outside, the nose hole is machined true with the bore, as that

operation was also done with the shell held in the same manner.

Two engine lathes take care of the final turning of the body diameter and profile. The carriages are fitted with radial tool slides of sector shape which are moved round the nose curve by means of a hand wheel on a pivotally mounted screw, the entire carriage being moved along the bed to machine the parallel diameter. During this operation, the shell is driven by an expanding arbor in the plain bore of the nose, while the base is still supported by the tail centre.

After having the thread milled in the nose on a Holden-Morgan miller, the shell is shop weighed and preliminary inspected after which the heat number or mark is transferred from the base to the body of the shell.

Wave-Groove and Base Recess

Waving is done on an ordinary engine lathe fitted with the Bertram grooving and waving attachment, the feature of which is a tool-holding bracket mounted on the bed underneath the shell, and

carrying a grooving tool at the rear and a waving tool at front, both of which are fed by cam rods fastened to the carriage and fed along with it; the waving tool is reciprocated by a cam on the face plate in the familiar manner. The thread in the nose is utilised to drive the shell while the base is still supported by the original centre so that concentricity is assured between the bottom of the band groove and the longitudinal axis of the shell.

Base recessing is handled in four stages; drilling machine, turret lathe, drilling machine, and engine lathe. In the first, the shell is held in a split chuck and drilled with a medium size centre-pointed drill to almost the depth of the recess; next, the recess is roughed out with a flat tool and a ridge formed on the base for riveting over on the base plate. Following this, the diameter is sized to gauge by holding the work in an angle bracket on the drill table, a pilot bushing fitting over the base of the shell and locating the recess concentrically; the fourth operation being to take a



VIEW IN LARGE DEPARTMENT SHOWING HYDRAULIC PRESSES FOR 6 IN. SHELL FORGINGS.

light final cut around the bottom of the recess, the work being held in a sleeve chuck in an outer bearing.

Washing, weighing, and shop inspection with all preliminary gauges is now performed, special attention being given to the finish of the bore, followed by preliminary government inspection in the government inspection department. The departments where this work is done are suitably situated so that the shells proceed continuously by rolling along the bench till they pass through a sliding door to the government officials, passing out again in a similar manner at a point where they receive the base plates. These plates are of standard type with square boss by which they are chucked while being turned and faced at the one setting. A Holden-Morgan base-plate machine is in use, the thread milling device being idle since plain plates were adopted instead of threaded. The square boss is cut off in a hacksaw immediately after the plates have been gauged.

Base Riveting and Finishing.

The riveting of the plates is done by pneumatic hammer clamped in a simple form of cast iron column, similar in shape to a light punch press. The shell rests in a revolving cup mounted on a horizontal hinge with a hand lever adjustment so that the hammer can be made to strike on any desired circle around the edge of the plate. After being carefully sounded with a hand hammer for any looseness, the riveted bases are finally faced, followed by the forming of a recess at the bottom of the nose threads, in order to provide a seat for a certain component. After hand tapping the threads, all burrs are removed on and under the seat, the three slots milled in the outside of the fuse seat and the nose gauged with the shop screw gauges.

Copper banding is done in a 6-cylinder radial press and the finish machining of the band in a Jenckes band turning machine with air chuck.

Inspection and Shipment.

The shell is now shop inspected with all final gauges and base stamped with makers initial, numerals and nomenclature.

It is now washed inside and outside and varnished, being finally inspected by the shop in the varnishing room, from which it passes by gravity convey-

ors to the government inspection department for final government inspection. On the conclusion of this, they pass along another gravity conveyor to the shipping room where threads are greased, shipping plug inserted, cleaned outside and given a coat of yellow paint, followed by boxing, official sealing, and placing in bond room to await shipment in cars. With the equipment described and handling facilities such as elevating transfer trucks, etc., an average output of fully 2,000 shells per week is continuously maintained.

6-Inch Shell Forging.

As mentioned at the beginning of the article, the forging of 6-in. blanks is also carried on in the same establishment, the equipment consisting of six oil-fired furnaces of the inclined type, three forging presses, and one accumulator of suitable capacity. This plant is housed in a portion of the main buildings which has a railroad track on either side so that the raw material, which comes in the form of billets cut to length, passes from the freight cars on to the storage platform at the back of the furnaces. Its movement is continuous thenceforward, as it emerges from the hot end of the furnaces at a spot convenient to the forging presses, and after forging is dropped through holes in the floor onto underground conveyor chains which elevate

special conveyors with formed wooden rollers used for handling 4.5-in. finished shells, being installed by the Canadian-Matthews Gravity Carrier Co. Three conveyors distribute the hot blanks over the cooling room floor, and a special elevating conveyor delivers the forgings directly to the cars on the second railroad track mentioned above.

Power Plant.

Low pressure air for the furnaces is supplied by two 42-in. Buffalo steel plate high pressure fans, driven by 30-horsepower Westinghouse motors. The powerhouse installation consists of hydraulic pumps for the presses and an air compressor for high pressure fuel supply to the furnaces. The former comprise two sets horizontal high pressure Deane Steam Pump Co.'s pumps, belt driven through reducing gears, by 250 horsepower General Electric induction motors using 30-in. belts.

The air compressor is built by the Union Steam Pump Co., and is also belt driven, by a 50-horsepower Fort Wayne Electric motor using an 11-in. belt. All of the electric equipment is of the 3-phase, 25 cycle type.

Kingston, Ont.—The need for help in the country is so urgent that the feldspar mines in some parts are being closed down and the men paid off.



INSTALLATION OF DISTRIBUTING GRAVITY CONVEYORS FOR 6 IN. SHELL FORGINGS



DEPARTMENT FOR FINAL OPERATIONS ON 4.5 IN. SHELLS

EDUCATION OF MARINE ENGINEERS

THE Council of the Institute of Marine Engineers, having considered the subject of the future supply of engineers for the merchant service, and also the qualifications of men to fill the higher and more responsible positions, realizing at the same time the important part the marine engineer must play in the development of the British mercantile marine, is of opinion that these questions require the earnest consideration of State departments and all parties directly interested in the shipping industry, and that immediately after the restoration of peace, steps should be taken to ensure that the marine engineer of the future will be trained so that he may be thoroughly qualified to meet any calls demanded by his profession. The views of the council are embodied in the following report:—

Apprentice Education

We are of opinion that the present system of education is capable of considerable improvement, and the Board of Education or other educational authority should be urged to take steps to improve it.

1—By giving boys at the ordinary schools, up to the age of 14, a sound training in arithmetic, mathematics, drawing, elementary physics, electricity and chemistry.

2—By providing an increased number of junior technical or day trades-preparatory schools at which boys between the ages of about 14 and 16 years preparing to enter on a mechanical career may attend, and where the elementary teaching of the subjects cited above, and their general education, including languages, may be further developed.

3—By encouraging and giving facilities to boys during their apprenticeship to attend classes in mathematics, mechanics and engineering, so that this period of their lives will be devoted to a combination of their practical and theoretical education.

4—By the provision of scholarships so that boys of exceptional ability may, after serving for a period of, say, three years or more in the workshops, continue their studies in the more advanced techniques of engineering, subject to the approval of their employers.

5—It is suggested that in large centres of industry it should be required that employers provide facilities during working hours for the technical education of at least a proportion of their apprentices.

Marine Engineers' Examinations

The examinations of marine engineers for first and second class certificates should embrace the technical subjects specified above and their application to practical engineering, and candidates should be required, as part of their qualification, to submit certificates or otherwise demonstrate that they have attained a certain standard of proficiency in mathematical and scientific knowledge.

The local or other educational authorities in all the large seaports should be urged to provide facilities in existing technical schools, or provide additional marine schools at which the course of study should be specially adapted for marine engineers preparing for their certificate examinations.

The requirements of first and second class engineers' certificates should be of a more exacting character, both as regards sea service and range of subjects set for the examinations, and a period should be set for the introduction of this higher standard.

Third Class B. O. T. Certificate

Simultaneously with the introduction of the higher standard of qualification, a third class Board of Trade certificate should be introduced.

The qualifications for examination for the third class certificate should be that the candidate should have the usual workshop training or its equivalent as now required for the second class certificate, together with one year's service at sea on regular watch, and the nature of this examination should be similar to the present examination for a second class certificate.

For a second class certificate the candidate should have a further sea service of twelve months in a qualifying capacity.

For a first class certificate the candidate should have a further sea service of eighteen months in charge of a watch.

Further to the proposals contained in the preceding paragraphs, we are of opinion that when the additional third class certificate is issued, the numbers of certificated engineers carried on the articles of all steamers should be revised.

Apprenticeship Period

We are also of the opinion that the qualifying period of apprenticeship should be at least five years. No time before the age of sixteen should be counted except in the case of junior technical schools, where time after the age of fourteen may be allowed at an appropriate value. Where the workshop service is performed in works where engines and boilers are made or repaired the following requirements are suggested:

Not less than 2½ years should be spent at fitting, erecting or repairing engines or machinery, either in the works or outside. The remaining 2½ years may be made up of time spent (1) at fitting, erecting or repairing engines or machinery; (2) at one of the other trades described below; (3) at an approved technical college. Time so spent to count as follows:—

Fitting, erecting, repairing or turning—Full time.

Working in drawing office—Full time up to two years, provided that an adequate period has been previously spent in the workshops, and beyond two years, half-time.

Pattern making—Full time up to twelve months; beyond twelve months, half-time, with a maximum allowance of two years.

Planing, slotting, shaping and milling—

Full time up to a maximum of one year.

Boiler-making, repairing, or smith's work—Full time up to one year; beyond one year, half-time, with a maximum allowance of two years.

Coppersmith work—Full time up to a maximum of six months.

Brass or iron moulding—Half-time up to a maximum allowance of one year.

Attendance at an approved technical college—Two-thirds time: equivalent allowance to be made for attendance at junior technical schools.

In the event of the apprenticeship time being extended to six years or more, five years at turning, followed by one year at fitting or erecting, may be accepted as qualifying.

Where the workshop service is performed wholly or in part in works where engines and boilers are not made or repaired, it may be accepted if it is considered useful training for an engineer, but in such cases additional service must have been performed either in a marine shop or at sea, as enacted in the present Board of Trade regulations.

It has been suggested that licenses should be granted to "handymen" to enable them to take charge in low powered steamers, or to take charge of a watch in larger vessels. We are of the opinion that this is not desirable.

In this report, under paragraph 1, the education and training of the marine engineer have only been considered in a general sense. It is our opinion that this important matter should form the subject of consideration before a joint national committee representative of all the various interests.



HORSE POWER OF BELTING

USERS of belting are frequently misled as to the amount of work which should be got from a good belt.

The power of belting is determined by the number of foot pounds which can be transmitted by one pulley to another, and is arrived at by multiplying the effective pull in pounds per inch of width by belt width in inches and by belt speed in feet per minute; thereafter dividing by 33,000.

The effective pull or the force tending to turn the pulley is the difference in tension between the slack and driving sides of the belt and is largely dependent on the arc of contact between the belt and the smaller pulley. To find the effective pull it is necessary to determine the number of degrees in the arc of contact. This can be arrived at by multiplying the difference between the pulley diameters in inches by four and three-quarters, dividing the product by the distance between the pulley centres in feet, and subtracting the quotient from 180 degrees.

The allowable working strain for a single belt with 180 degrees contact is, 40 pounds per inch width. This multiplied by the arc of contact found in the previous calculation and divided by 180 will give the effective pull allowable in pounds.

PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data
and Ideas Evolved from Actual Practical Application and Experience

ANOTHER USE FOR THE LATHE

By D. S. M.

If a small shop devoted mainly to the repair of autos, motorcycles, lawn mowers, etc., a lathe with rather a long bed was in use. A great deal of auto cylinder reboring came to this shop, and the grinder shown in the accompanying photo was built and attached to the end of the lathe bed. It was readily removable in case of necessity. The carriage carrying the cylinder fitted the regular vees of the bed, and was provided with a power feed from the lead screw, this being at the back of the bed. It was driven, when used for the grinder, by the belt shown at the extreme right. This lathe was quite old; it will be noticed that the regular feed shaft is at the front. When reboring a cylinder preparatory to regrounding, the wheel was removed and the cutter head standing on the lathe bed screwed on to the end of the arm carrying the spindle. The centre belt supplied the power to the grinding

slowly. This will enable the piece to be machined without difficulty and will save the price of many an intricate casting. This little kink has proved itself especially useful when machining thin pulleys, the edges of which are often extremely hard. The edge of the pulley was heated and dipped directly into the sulphur.

DON'TS FOR MACHINISTS.

By S. B.

Don't use a scale for a scratch awl or a chisel.

Don't make an anvil of the saddle or the tail-stock.

Don't litter the saddle with a lot of tools or material.

Don't allow grit or dirt to gather in the centre lubricant; this will often cause serious trouble.

Don't use the fingers to clean out small bored holes; the fingers may easily be injured.

done on poor centres; these should be kept in good condition and maintained at an angle of 60 degrees.

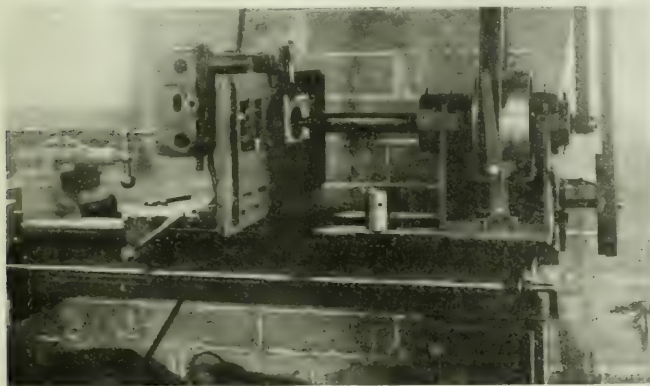
Don't slack off the gib screws unless the slide is too tight; the stiffness may result from an accumulation of dirt or grease, which should be removed.

Don't forget that heat will be generated very rapidly when turning small shafts, causing them to elongate; the tail centre requires to be eased back to avoid buckling or distortion of the shaft.

HORSEPOWER REQUIRED TO CONVEY MATERIALS.

By N. G. Near.

CONVEYORS are becoming more and more in evidence, and as a result it is increasingly important that we know more



ANOTHER USE FOR THE LATHE.

wheel spindle, the eccentricity of which could be adjusted to suit by means of screws in the inner end of the main shaft.

SAVING THE HARD CASTING

By A. S. Loy.

WHEN running on to a hard spot in a casting when machining, don't throw the casting away and then condemn the foundry. Perhaps they have had some troubles of their own, and sometimes the foundry superintendent is not always supplied with the grade of iron which he orders. To keep things running smoothly, simply heat the offending part red hot and place a little sulphur on the hard spot allowing the casting to cool

Don't start work on a new machine until you acquaint yourself with the operating mechanism.

Don't get the habit of using belt dressing whenever the belt slips; look elsewhere for the trouble.

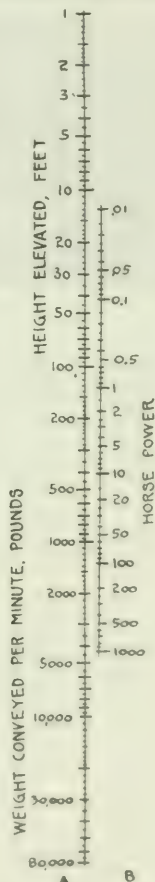
Don't fail to see that the hollow spindle and the centre are perfectly clean when the latter is placed in position.

Don't use metal belt fasteners on belts that are to be shifted by hand; loose ends are very dangerous.

Don't forget that it is often a costly practice to pull cuttings from the work while same is in motion.

Don't over lubricate screws and slides that are exposed to dirt or cuttings; occasional cleaning and light oiling are more efficient.

Don't think that good work can be



CONVEYOR HORSE POWER CHART

about the power required to convey. Almost everything is being conveyed these days, but in and about the power plant coal and ashes are the principal materials. However, no matter what the material, whether coal, ashes, wheat, oats, barley, corn, gravel, clinker, cement, or what not, this chart will do the work so long as the weight to be handled per minute is known. The method of using the chart is the same as with other charts of a similar nature already published, but to make it perfectly clear we will take an example.

Let us suppose that you wish to convey 35,000 pounds of coal per minute to a height of 50 feet. What horsepower will be required?

Find the 35,000 in column A, and then find the 50, also in column A. Next find the point half-way between these two. Directly opposite the mid-point is the answer—100 horsepower.

Of course this answer is not "absolutely accurate," because every conveyor has friction to contend with, but this chart is based on average practice, and the results can generally be depended upon. Therefore, if the conveyor is to be

Still again, knowing the weight to be conveyed and the horsepower, the possible height is obtained in the inverse manner. After working one or two problems, the reader will have no difficulty in understanding the chart and solving any one of the three kinds of problems.

USING OLD PRINCIPLES IN NEW WAYS

By D. O. B.

IN the construction of the ordinary gas tractor, it is customary to make the main frame from standard steel sections, either I-beams or channels. Having the webs solid, the bearings for the countershafts must be placed either above or below, otherwise it becomes necessary to cut through the web with a consequent weakening of the beam. In the gas tractor truck shown in the accompanying cut, the designer departed from the usual practice and made use of the principles of design which have been successfully carried out in other lines, such as the construction of bridges and car trucks. It will be noticed that the

should each have consideration. A choice of pulleys which fulfils these requirements may mean a somewhat high initial outlay, but will mean annually much reduced operating expense.

Pulleys as manufactured are of cast iron, wrought iron, mild steel, wood and iron or steel in combination. For good belt contact, minimum slippage, and least power absorbed without undue recourse to belt dressings to secure adhesion, the wood rim is to be commended. It should, of course, be borne in mind that there are good and bad features in wood pulleys. Belt contact, reduced weight, and facility of handling, are, generally speaking, strong points in their favor, but unless at least the equivalent windage of a well-designed cast iron pulley be had, the other gains may be partly offset. The properly designed wood pulley should be the equal of other types in their best features, and their superior otherwise.

An absence of windage is not always a feature of wood pulleys. The improvement necessary in the reduction or absence of windage in wood pulleys lies in the arm attachment between rim and hub. The arms should be of a shape corresponding to those in cast iron or similar; the material light, rigid, reliable, and attached securely to rim and hub.

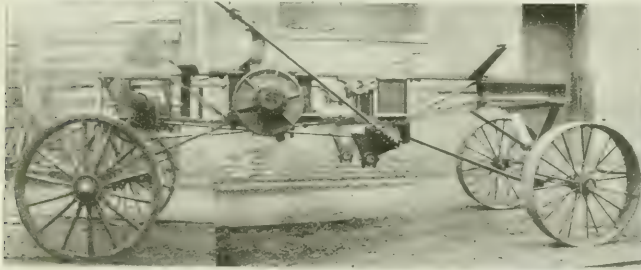
The wood pulley has advantage over those of iron or steel, in that it can be run at a much higher speed.

The outer face of a belt travels faster than the inner, causing compression of the latter and extension or stretching of the former. This process has a naturally injurious effect on the substance and life of the belt and should be minimized to the fullest extent possible by using large diameter pulleys, those especially with little crown. Horizontal shaft pulleys should have about $\frac{1}{4}$ inch per foot crown, while those on a vertical shaft should have about twice that amount.

Installation of Belting

In applying new belts, care should be taken that the proper side goes next to the pulley. Belts have what is known as a flesh and a hair face; the former of which to the uninitiated might suggest itself as the driving face. This is not so, however, for the reason that the flesh face being tougher, is better able to stand the stretching already referred to, and the hair side which is predisposed to cracking, wears better under compression.

The top end of splices connecting the laps should point in the running direction of the belt. Horizontal belts and angle drives up to 45 degrees from the horizontal plane, should have a sag of about $\frac{1}{4}$ inch per foot, and the underside be the driver. Vertical belts should be pulled tight to ensure grip on the lower pulley. Shafting and machinery should be so arranged that belts will run from the former to the latter in opposite directions to equalize the strain and pull on the bearings. Increase of belt width should mean a corresponding increase in thickness, and it is probably true that a thick and narrow belt is more durable and works rather more satisfactorily than does one wide and thin.



USING OLD PRINCIPLES IN NEW WAYS.

operated by electric motor, one would be safe in buying a 100 horsepower motor for the conveyor. It is generally better to be equipped with apparatus that is able to do just a little more than required of it, because of overloads that sometimes spring up unexpectedly. This is a well-known engineering practice and needn't be enlarged on here. In other words, to use the chart, find the mid-point between the two known values in Column A and the answer is immediately found opposite the mid-point in column B.

The chart can be used in the "reverse" way also. If you have a given engine or motor and a given height to which materials must be elevated, and the weight that can be handled per minute is required, simply find the distance between the known point, column A, and the known point column B, and measure downward from the known point in column B. The answer will be found in column A.

For example, again, if the height to be conveyed is 50 feet and the horsepower is 100, find the distance between the 50 and the 100 and measure downward from the 100 and the answer is found in column A to be 35,000 pounds per minute.

main frame is constructed in the form of a truss, with three main members, the compressive stresses being cared for by the vertical castings. This not only produces a lighter frame for a given strength, but also leaves the centre open so that the bearings may be placed at the most convenient point without making other sacrifices in the design.

In designing any piece of machinery, it is not always necessary to follow in the beaten path, and some of the greatest successes have been due to the fact that some of the designers have been able to strike out for themselves and adapt principles which were, of course, sound, to some new line. Oftentimes engineers secure the most valuable ideas from some field entirely foreign to that in which they are working; they should, therefore, be on the alert at all times to see if it is not possible to make some new and valuable adaptation of an old principle.

BELT PULLEY NOTES

IN determining what pulleys are best to use in any equipment, the factors of windage, weight, balance, belt contact, powerful compression to avoid keyseating of shaft, and convenience of handling

Development of Ocean Service Shipbuilding in Canada --V

By C. T. R.

In addition to the widespread requisitioning of vessels for transportation purposes by the Allies, the war attendant and normal merchant ship losses and the many months' almost complete cessation of new construction on the part of the latter, the merchant marine of the world has had the misfortune to become to a large extent the target for enemy submarine activity. All nations have suffered in this respect, hence the almost feverish anxiety being displayed by shipping interests to have the losses made good at the earliest possible moment.

OCEAN GOING OIL TANKER LAUNCHED AT COL- LINGWOOD

THERE was launched by The Collingwood Shipbuilding Co., Collingwood, Ont., on Thursday, June 21, the oil tank steamer Reginolite, which has been built to the order of the Imperial Oil Co., Toronto. This is the fourth vessel the builders have constructed for The Imperial Oil Co. and leaves a fifth, the Talarolite still on the stocks. The Reginolite is intended entirely for ocean service and is of the following dimensions: 250 ft. between perpendiculars; 259 ft. over all; 43 ft. 9 in. beam; 25 ft. deep to the upper deck, deadweight carrying capacity, 3500 tons.

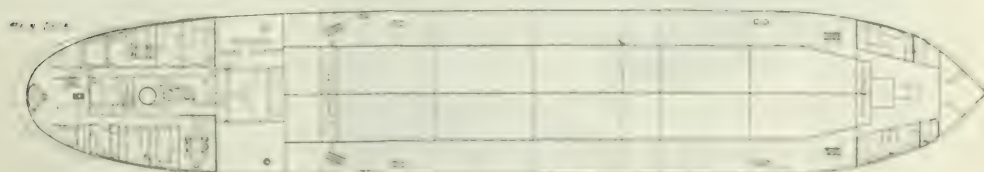
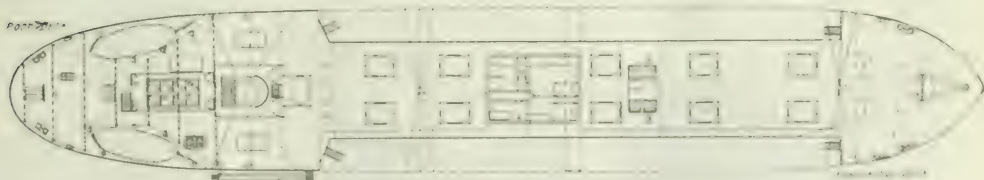
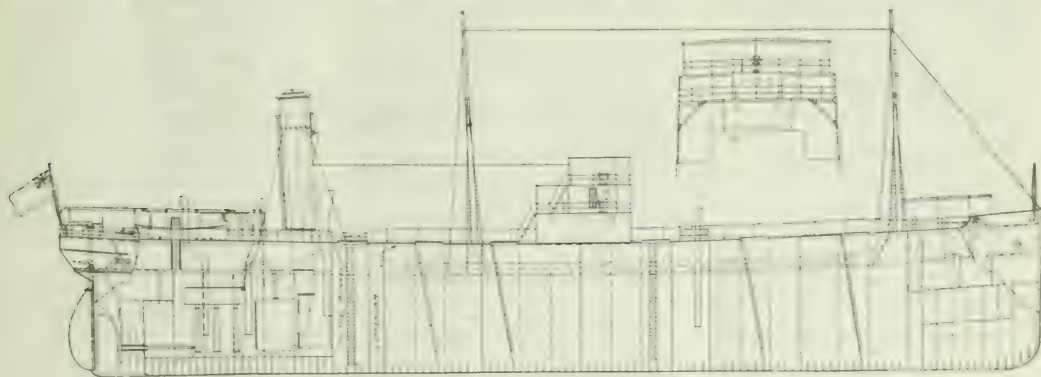
The propelling machinery consists of a set of triple expansion engines with cylinders 18 in., 30 in. and 50 in.

by 36 in. stroke. Steam is supplied by two Scotch boilers 13 ft. 6 in. diameter by 11 ft. long, working at 180 lbs. pressure. The vessel takes the highest class in Lloyd's Registry for ocean service and the construction has been under the supervision of Captain R. W. Henderson, marine superintendent for the owners. From the line drawing showing the vessel profile and deck plans, a very good idea is to had of the general design and detail arrangement.

"WAR WASP" LAUNCHED

ON July 9, the steel freighter War Wasp was successfully launched from the shipbuilding plant of the Nova Scotia Steel & Coal Co., at Trenton, N.S. She is the first ocean-going steel steamer to be built in the Province of Nova Scotia, and naturally the event created unusual inter-

est. Residents of New Glasgow and Trenton were out in large numbers to witness the vessel take to her native element, in addition many visitors from adjacent towns helped to swell the crowds who lined the banks of the East River. Miss Marion Cantley, daughter of the chairman of "Scotia," performed the christening ceremony, following which Mayor Grant presented Col. Cantley with a piece of silver from the citizens of New Glasgow, to commemorate the occasion. Congratulatory addresses were also presented to Col. Cantley by the town councils of Trenton and New Glasgow. A description and illustration of the War Wasp appeared in our April 5 issue. We understand the vessel has been sold to the British Government, although primarily intended for the company's own coal and ore-carrying trade.



PROFILE, POOP AND MAIN DECK PLANS OF OIL TANKER "REGINOLITE"



OIL TANKER "REGINOLITE" ON THE WAYS

INSTITUTE OF METALS CONVENTION PROGRAMME

THE tentative programme for the meeting of the American Institute of Metals, to be held September 25-28, at Boston, has been issued. Separate sessions will be devoted to the discussion of crucibles and furnaces, the melting and casting of nonferrous metals, casting in connection with munition making, the testing of nonferrous metals and metallography. The tentative list of papers is as follows:

Crucibles and Furnaces:

"The Crucible Situation," by Prof. A. V. Gleininger, Bureau of Standards, Pittsburgh.

"Melting Yellow Brass in New Form of Induction Furnace," by G. H. Clamer, Ajax Metal Co., Philadelphia.

"The Crucible Situation," by M. McNaughton, Joseph Dixon Crucible Co., Jersey City, N.J.

"The Electric Furnace and Nonferrous Metals," by Dwight D. Miller, the Society for Electrical Development, New York.

"My Experience with Metal Melting

Furnaces," by W. H. Parry, National Meter Co., Brooklyn.

Melting and Casting Nonferrous Metals:

"Casting Bearings in Sand and Metal Molds," by R. R. Clarke, Pittsburgh.

"The School End of the Job in Training Foundrymen," by C. B. Connelly, Dean, Carnegie Institute of Technology, Pittsburgh.

"The Flux and Cleaner Question of Brass," by E. A. Frohman, S. Obermayer Co., Pittsburgh.

"Negative Experiments on Waste Core Sand," by Dr. H. W. Gillett, Bureau of Mines, Ithaca, N.Y.

"Pyrometers—Their Construction and Application," by John P. Goheen, Brown Instrument Co., Philadelphia.

"Surface Tension and Deoxidizing of Metals," by W. J. Knox, Metals Deoxidizing & Refining Co., New York.

"The Briquetting of Nonferrous Light Metal Scrap," by A. L. Stillman, General Briquetting Co., New York.

"The Swelling of Zinc Base Die Cast-

ings," by H. M. Williams, National Cash Register Co., Dayton, Ohio.

Munitions, Etc.:

"The Present Status of Tin Fusible Plug Manufacture and Properties," by Dr. George K. Burgess, Bureau of Standards, Washington.

"Stellite," by Elwood Haynes, Haynes Stellite Works, Kokomo, Ind.

"Fire Prevention in Large Industrial Establishments," by C. W. Johnson, Westinghouse Electric & Mfg. Co., Pittsburgh.

"The Use of Die Casting in Munitions," by Charles Pack, Doehler Die Casting Co., Brooklyn.

"A Few Points on Alloy Patents," by William J. Rich, Patent Office, Washington.

"Shrapnel Bullets," by Harold J. Roast, the James Robertson Co., Ltd., Montreal.

"Recent Industrial Uses of Aluminum," by F. G. Shull, Aluminum Co. of America, Boston.

Testing Nonferrous Metals:

"Some Comparative Tests on Test Bars and Actual Castings," by W. M. Course, the Titanium Alloy Mfg. Co., Niagara Falls, N.Y., Buffalo.

"Analysis of Babbitts and Brasses," by E. W. Hagmaier, Buffalo.

"Standard Test Bars of 88-10-2 and 88-8-4, Being the Result of Co-operative Work of Six Foundries; a New Series of Tests," by C. P. Karr, Bureau of Standards, Washington.

"The Expansion Coefficients of Alpha and Beta Brass" and "The Corrosion of Manganese Bronze Under Stress," by Dr. Paul D. Merica, Bureau of Standards, Washington.

"Corrosion of Brasses of the Muntz Metal Type," by H. S. Rowdon, Bureau of Standards, Washington.

"Analysis of Cadmium in Brass," by Dr. F. Schramm, Bureau of Standards, Washington.

Metallurgy and Metallography:

"The Electrolytic Production of Antimony," by Prof. D. J. Demorest, the Ohio State University, Columbus.

"The Electrical Properties of Some High Resistance Alloys," by Prof. M. A. Hunter, Rensselaer Polytechnic Institute, Troy, N.Y., and F. M. Sebast.

"The Amorphous Theory in Metals," by Prof. Zay Jeffries, Case School of Applied Science, Cleveland.

"The Uses and Metallurgy of Antimony," by K. C. Li, Wah Chang Mining & Smelting Co., Inc., New York.

"Development and Reabsorption of the Beta Constituent in Alloys Which Are Normally of the Alpha Type," by Prof. C. H. Mathewson, department of mining and metallurgy, Yale University, New Haven, Conn., and Philip Davidson.



Financial Aid for Drydocks.—The Dominion Government has decided to increase the subsidy for drydock undertakings by way of promoting them. A subsidy representing a percentage of the total outlay has heretofore been given. This percentage will be raised, because at present it is an insufficient encouragement to build docks.



OIL TANKER "REGINOLITE" ENTERING THE WATER.

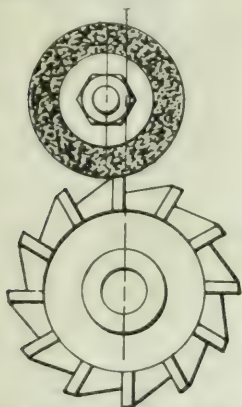
EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions—Your Co-operation is Invited

MACHINISTS' INSTRUCTION COURSE—XXV.

By J. Davies.

WHILE most grinding machines are provided with graduations to facilitate the setting of the various heads and holders, these aids should not be absolutely relied on. When



ARC CLEARANCE ON THE LAND.
FIG. 92.

adjusting the machine, set the swivels to the desired graduations to conform to the angle required; for example, suppose you wish to grind a parallel bar or cutter, it is first necessary to see that the graduations are set to the zero mark, then take a trial cut and test with the

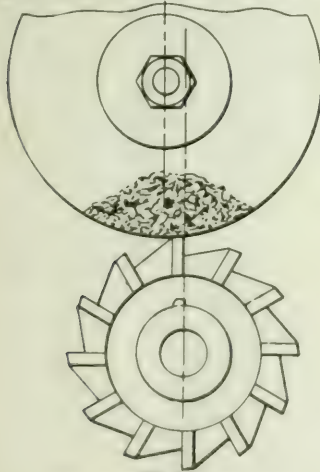


FIG. 93.
ARC CLEARANCE ON THE LAND

micrometers. By carefully noting the appearance of the sparks an experienced operator can rectify any error he can

detect with the measuring instruments. A tool-room grinder is the most sensitive machine in the shop; that is to say, you can remove the least amount of metal in one cut by this method, it being practically impossible to remove fractions of a thousandth by the use of an edge tool. If you were not grinding anything off at one end and .0001 inch off the other end, it is possible to detect it by the condition of the sparks. When finishing a very fine or accurate piece of work, let the sparks nearly die away to take all the spring out of the arbor.

When grinding or backing off the land of a cutter or reamer with an ordinary disc wheel, cutting on its periphery or outside diameter, the shape of the clearance, left on the land of the cutter, must of necessity conform to the shape of the wheel, and will, therefore, be ground hollow. This condition is all right for a razor, but inefficient for a milling cutter. The larger the grinding wheel used, the less pronounced will the arc be on the back of the cutter. By using a cup wheel

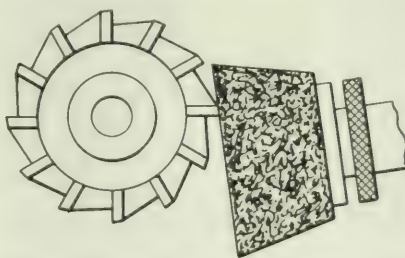


FIG. 94. STRAIGHT CLEARANCE ON THE LAND.

the land of the cutter can be ground perfectly flat. The ideal form of clearance is the eccentric shape as shown in the sketch, Fig. 95; this gives a well-supported cutter edge, but unfortunately it is a very difficult shape to grind without a special machine or attachment. Fig. 92 illustrates a very poor method of backing off; the hollow form of the clearance being excessive by the use of too small a grinding wheel. Fig. 93 is an improvement on Fig. 92, as the arc on the land is much reduced by using a wheel as large in diameter as possible. Fig. 94 shows the general practice for backing off the teeth, the flat surface being obtained by using a cup wheel. The theoretical correct form of clearance is illustrated in Fig. 95, the outer edge of the land taking the shape of an arc eccentric with the diameter, and the centre of which would fall within the cutter and close to the centre of the latter; this, however, is seldom used owing to the special facilities required to produce the desired shape. An approximation to this land can nevertheless be obtained by draw filing the land before

hardening or by using a hand stone afterwards.

Figs. 96 and 97 show two methods of setting up bevel cutters for grinding. In Fig. 96 a cup wheel is used, which leaves a flat surface, the headstock or attachment that holds the work being swivelled to correspond to the angle of the cutter.

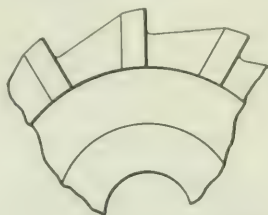


FIG. 95. ECCENTRIC CLEARANCE

The guide finger is then adjusted to keep the tooth being ground in the same plane as the table; this can be tested with the surface gauge. The grinding spindle is then tilted and clamped at the proper angle for clearance and the work moved past the wheel by the cross feed. Fig. 97 shows the cutter mounted on a bar held in a swivel head device, which is set by the graduation, or by a surface gauge from the table. The guide finger is adjusted and the cutter is traversed past the face of the grinding wheel by moving the table to which the holding attachment is fastened.

Space does not permit to enumerate one-tenth of the attachments and ingenious devices designed for and used on the modern grinding machine.

For any kind of repetition work it pays

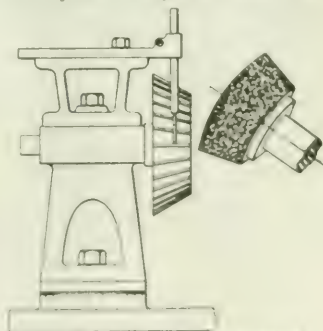


FIG. 96. GRINDING BEVEL CUTTERS

to construct a special holding device, as that is practically what all grinding jigs consist of; some means of holding the

work to be ground in proper relation to the grinding wheel, and a fixture that can be set quickly and accurately. One of the most useful standard attachments

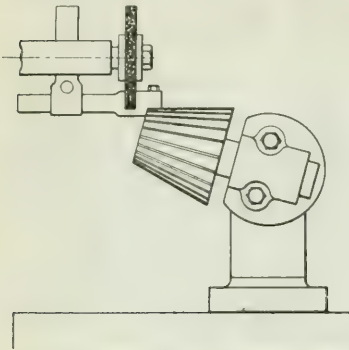


FIG. 97. GRINDING BEVEL CUTTERS WITH DISC WHEEL.

is the vee centre head. Fig. 98 illustrates how a pair of these may be used for holding a piece that is too long to go between the centres, or a reamer with an extremely long shank. By putting a plate across the vee-shaped jaws it can be converted into a vise for holding flat work.

Fig. 99 is an example of grinding a shaft close up to a large shoulder; it can be seen at a glance that an ordinary flat wheel could not be used because the nut and washers necessary to fasten the wheel to the spindle would not clear the shoulder of the work, and for this reason some form of dished wheel is necessary. When preparing a piece of work to be ground right up to a shoulder or square corner, always slightly undercut the work in the corner to the finished size, or a little below if the work will permit it, as it is extremely difficult to keep a perfectly square corner on a grinding wheel.

The grinding of a snap or caliper gauge is shown in Fig. 100; the gauge is fastened to the table by any convenient means, particular care being taken that it is not sprung in any way when fastening it down. The wheel should be set at right angle to the table and recessed at both sides as shown, so that the cutting

surface of the wheel will pass entirely over that portion of the gauge being ground. In grinding a saw of any kind, provided with a jig having a spacing device, always fix the locating finger or other indicating device, in the space next to the tooth being ground, in order that every tooth will be of uniform shape and dimension.

On internal work it is obvious that the grinding wheel must be smaller than the hole to be ground; when working on very small holes it is impossible to obtain the correct cutting speed, although as high a speed as 50,000 revolutions per minute has been obtained on specially designed machines. Under these conditions it is very advisable to get all the speed possible with the machine and tools available. The lower we fall below the proper speed the more pressure will be required to make the wheel cut; use a soft wheel, and if there is any looseness whatever in the spindle, extra care is required when the wheel strikes the sides of the hole, as there is a great possibility

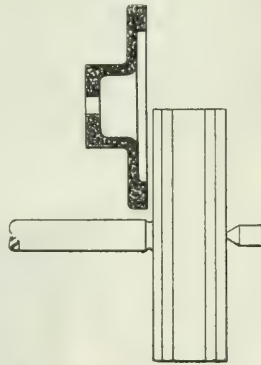


FIG. 99. GRINDING TO SQUARE SHOULDER.

of making the hole larger at the ends. To avoid this tendency, shorten the travel so that the width of the wheel is always in the hole.

VARIATION IN SHELL FORGINGS

By R. Hamilton

IT has been estimated by a certain manufacturer who has been machining

6 inch shell for a couple of years, that from one to two dollars is wasted on every shell forged in Canada. This firm has, owing to existing conditions, been

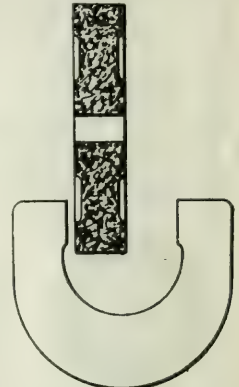


FIG. 100. GRINDING SNAP GAUGES.

forced to obtain or accept forgings from whatever source these were available, and its experience, which is undoubtedly that of many others, has demonstrated the advisability of forging to much closer and more accurate dimensions than has been the general practice here. This particular plant has found that the production from shell forged in the States has resulted in an increased machining output of from 10 to 20 per cent., over similar blanks forged in this country. Roughing operations on the different forgings have had a variation often as great as 40 per cent.

Neglecting the physical qualities of the steel which it is understood are invariably more uniform in the American made product, the feature that makes the difference is that of the dimensions of the rough forgings; the Canadian blanks averaging about $\frac{1}{4}$ inch larger on the outer diameter and about $\frac{1}{8}$ inch smaller in the bore. This approximates

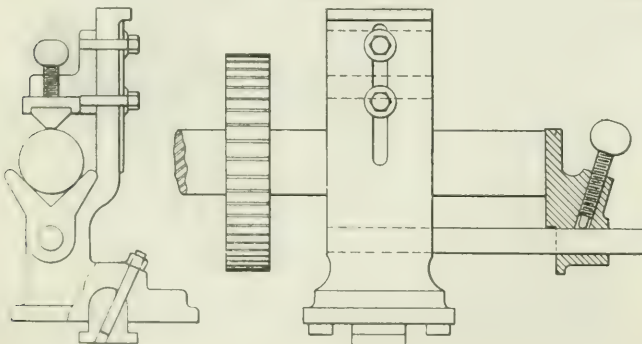


FIG. 98. GRINDING WITH VEE BLOCKS.

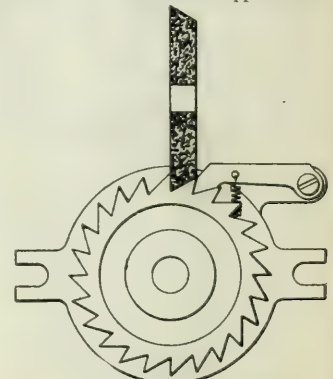


FIG. 101. GRINDING SAW TEETH.

a surplus of between 25 and 30 pounds on each forging; which at say 5 cents per pound, runs to about \$1.40 on every

shell. In addition, however, to the extra weight of metal, the factor of concentricity is more pronounced in the American made forging, necessitated by the adherence to closer working dimensions. It has often been noticed on many Canadian made shells that the eccentricity has been such as to require a $\frac{1}{8}$ inch depth of cut on the heavy side of the forging against $\frac{1}{16}$ or $\frac{1}{8}$ inch on the opposite side. This condition is not general, but is nevertheless so common as to emphasize the contrast between the different makes of forgings.

To produce shell blanks that will minimize the roughing operations in the machining of the shells necessitates greater accuracy in the forging process, but the extra attention given at this initial stage more than offsets the increased difficulties contingent on the machining of extra heavy and abnormally eccentric forgings. It is therefore much more economical to work to close dimensions during the forging process, as the ultimate results mean less waste, due to scrapped and dejected shells, much of which can be directly traced to the original excessive eccentricity.



SHELL INSPECTION.

By J. H. R.

MANY reports have been circulated as to the apparent unfairness of shell inspection, resulting in much inconvenience and often material loss to manufacturers. In view of the abnormal conditions under which the munitions industry has been expanded, it was to be expected that the problem of effective inspection would unquestionably be a serious one, but while there have evidently been many faults in the methods adopted, it is nevertheless true that, with few exceptions, the work has been carried on with the main object of efficiently protecting those whose duties involve the handling and discharging of the shells on the various battle fronts. The very large number of men required for the progressive and final inspection of shells made it, of course, practically impossible to obtain a sufficiency with previous experience that would especially qualify them for this seemingly incidental but none-the-less essential work.

With the probable exception of a number of the chief inspectors the work was detailed to men whose knowledge of steel and scientific measuring instruments was in many features very meagre, their effort in consequence, was rather that of the automaton than of men well primed with technical and mechanical ability. Their judgment was more of the hand than of the brain, and where a possible doubt arose, they invariably safe-guarded themselves by placing the shells in question to one side, to be subsequently examined by the chief inspector. Under the circumstances this practice is no doubt the safest to follow, but it has often placed the plant executive in temporary difficulties, owing to the accumulation of semi-finished or finished product. The preliminary or pro-

gressive inspection of shells has now become one of gauging only, as the under inspectors, invariably, will not pass a shell unless the requirements are exact; the question of reasonable judgment and application of gray matter being the duties of the district or chief inspector.

It is claimed that shells primarily rejected by the local inspectors are placed aside for examination by the district inspectors, and if finally passed by this authority, are done so subject to a discount of 5 per cent. on the manufacturers' price. Just recently a certain plant had a considerable percentage of a series placed in the "doubtful" section, over 90 per cent. of which were subsequently passed by the district inspector; an apparent injustice to the manufacturer. This particular firm—making six inch shells, have three floors equipped for progressive production; forgings entering the basement and progressing to the top floor, where they receive their final inspection. When commencing work at this plant, considerable inconvenience was experienced from the inspection methods, which often necessitated shells being sent back to the floor below for correction of errors. This has now been adjusted by the placing of a reliable inspector on each floor, so that once the shells are taken to the floor above, they are never required again to pass to the one below. The comparatively small remuneration, in relation to that received by the average machine operator, is a feature that tends to place the work of inspection on a physical rather than an intellectual basis. The importance of this essential phase of munitions manufacture deserves equal consideration with the machining operations, to insure proper and complete co-operation.



BRITISH ADMIRALTY WANTS B. C. LUMBER

WHILE British Columbia has, for the past two years, been supplying the Imperial Government with quantities of silver spruce for use in the manufacture of aeroplanes, and repeated inquiries have been made of British Columbia lumber concerns as to the possibility of securing still greater supplies, the Admiralty has again made inquiries as to the likelihood of large quantities being secured. Premier Brewster is in receipt of inquiries from the Admiralty, and Hon. T. D. Pattullo, Minister of Lands, is now securing information and will forward it to London.

Not long ago it was announced from Portland that an embargo against exports of such materials to England had been placed against the Northwestern States and British Columbia. The Forest Branch here took the matter up, but could get no definite information other than so far as was known in England no embargo existed against British Columbia. A considerable quantity of spruce which is being used in the manufacture of aeroplanes for service at the front, has been shipped from the Province. The great demand in England evidently must be met by further importations of the British Columbia product.

RAILWAY BOARD TO OPERATE C. N. R. AND G. T. P.

OPERATION of the Canadian Northern and Grand Trunk Pacific Railways by a board appointed by the Government is involved in the plans which were submitted to a caucus of ministerial supporters at Ottawa last Friday.

Nationalization at this stage is not proposed because, in view of the heavy expenditures incidental to the war, the financial burden would be too heavy. Complete control is the interim remedy. The plan goes further. It contemplates such co-ordination of the service of the three roads as will obviate unnecessary expense in operation and thus tend to reduce, if not wipe out altogether, the recurrent deficits of these roads. The corporate identity of the companies will be retained, but some changes made in the directorate. Railway experts are proposed for the operating board, and the idea is to eliminate unnecessary duplication of lines, and generally link up the services.

Financial assistance by the Government to the extent of about thirty or forty millions will enable the companies to meet their maturing obligations and renew the short-date issues on the New York and London markets.

The scheme, as stated, does not involve any Government ownership now, but is designed to provide effective financial and operative control, and leave the door open for the wider plan of ultimate nationalization when the country's finances permit of it.



STATIONARY ENGINEERS' CONVENTION.

THE 28th annual convention of the Canadian Association of Stationary Engineers, held in Toronto on July 24th, 25th and 26th, was up to the high standard of previous gatherings, both as regards the discussions at the meetings of the delegates and the exhibit of power supplies. In the exhibition hall about fifty manufacturers occupied booths, making an interesting display of power plant equipment and supplies, and showing the development in these lines by way of securing greater efficiency and saving in power. The C. A. S. E. have recently secured a Dominion charter and will thus be enabled to extend the scope of its activities. The executive are endeavoring to arrange for provincial reciprocity in licenses, and it is hoped that graded certificates will be given in 1918. Legislation to this end has been inaugurated. The convention next year will be held at London, Ont.

The following C. A. S. E. executive officers were elected for the ensuing year: Past President, W. G. Forbes; President, R. G. Gofton; Vice-President, W. Cooke; Secretary, John H. Hale; and Treasurer, A. W. Heath. The officers of the Exhibitors' Association are as follows: Past President, Earl Hetherington; President, Flight-Lieut. Lloyd Archibald; 1st Vice-President, C. W. Schrag; 2nd Vice-President, J. S. Mock; Secretary, Gordon C. Keith; Assistant Secretary, L. H. Rumage; and Treasurer, B. G. Newton.

PROCESSES IN MANUFACTURE

Inventive Genius and Research Operate to a Dual End—They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

HAMMER-HOUR OVERHEAD SYSTEM FOR DROP FORGE SHOPS*

By R. T. Herdegen.**

THE success of any drop forge plant depends upon many different factors. Of all of the latter which play a part in the industry there is none of greater importance than the

began to realize that the division of overhead on the basis of productive labor charges could no longer be used. It was easily possible, for example, for a swift man working on a small, inexpensive shaper, to make almost as much money as a man working on the large and many times more expensive planer. The ma-

hammer. It is possible for a man operating a board hammer to draw the same amount of pay for a day's work as the man operating an equivalent steam hammer. With the percentage system of figuring overhead, the actual overhead charge against a job would be the same whether run in the board or the steam hammer. This we know is not theoretically correct. Take another example.

Consider a 5,000 lb. steam hammer running on a comparatively light job which requires a hammerman and only one heater. This very same hammer might, the following week, be used for a very heavy job which would require a hammer-man, a couple of heaters, and a scale blower. Using the percentage system of figuring overhead, the second piece of work would have a greater overhead charge against it per hour than the first piece, and yet from a theoretical standpoint the actual overhead charge should not be very different for the two jobs for the same period of time. The probable truth of the matter is that the actual charge in the first case is too small, and in the second case is too large.

It would be possible to cite examples without end showing improper costs obtained by using the percentage system of figuring overhead, but we will assume that all are agreed that a hammer-hour rate system is the proper one, and will develop a method for properly apportioning the overhead charges among the various pieces of equipment in the forge plant.

Operation of Hammer-Hour Rate System

The overhead for the entire factory is

TABLE I.—PERCENTAGE BASIS FOR GROUP DIVISION OF OVERHEAD CHARGES.

Group No. Letter Un.	Type and Size Units	Wgt. lbs.	Pcs.	Steam Const.	Elect. Const.	Stm. Elect.	Floor Space	Asset Value	Furn. Val.	Die Charge	Outp't Km
A 5	Board	17	41		43	22	30	24	25	14	22
B 2	Medium and Small	11	11	22	3	12	13	13	14	12	18
C 2	2500 and 3000 lbs.	33	22	35	5	20	22	20	29	33	31
D 1	5000 lbs.	20	11	43	6	25	11	23	16	25	18
E 1	Small Upsetter	7	5		14	7	9	6	7	6	4
F 1	Large Upsetter	12	10		29	14	16	14	9	10	7

proper determination of costs. Regardless of a favorable location, good management, and ample finances, if the costs are not accurately known, the plant will never be permanently successful.

There are three main items entering into the cost of any forgings, viz.: material, labor and overhead. The material required for any forging is easily determined, but proper allowance should always be made for defective work and scrap. The productive labor cost is also a simple matter to obtain. With an office time-keeping department properly organized and with men in the shop checking up all counts, the opportunity for error in this particular direction is small. The overhead item, however, affords a great opportunity for most careful study. It is comparatively speaking, a simple matter to obtain the sum total overhead charge for any specific period of time, such as a year or a month. The difficulty arises when it is desired to segregate this sum total overhead for application to the various jobs that were run during that period.

The time honored system of dividing this overhead is on the basis of productive labor. It is a simple system and has been passed on to the forging business from machine shop practice. In machine shops of several years ago, the system used was to charge the proper productive labor to the various jobs, and at the end of the month to divide the month's overhead among the various jobs on the basis of the productive labor charge against each job. This system was reasonably satisfactory, particularly if the machine tools were of about the same initial cost, and if the operators on the various machines earned about the same wage.

With the advent of massive machine tools, however, the machine-shop men

chase shop men thereupon started the system of charging the overhead against the large planer at so much per hour regardless of the productive labor charge. This was the beginning of the machine rate system. It was an effort to divide overhead on a basis independently, as far as possible, of productive labor.

Hammer Hour Rate System.

The forge business is now duplicating the experience of the machine shop. Several forge shops have already abandoned the old system and are now operating under the machine rate system, or as it is called in the forge business, hammer-hour rate system. The overhead costs obtained by the percentage system are fairly reliable in a small shop, particularly where all the units are of the same size and of the same type. A shop,

TABLE II.—NON-PRODUCTIVE LABOR ITEMS AS CHARGED TO MACHINE GROUPS.

No.	Non-productive Activity.	Total	A	B	C	D	E	F
			2-1500	2-2500	1-5000	Small	large	Up- Up-
			lbs.	lbs.	lbs.	Up-	Up-	setter
S-1	Repairs to Machinery	618.29	117.55	132.42	164.41	145.06	20.20	38.64
S-2	Unloading Rough Stock—Bar Steel	73.29	12.46	8.06	24.19	14.66	5.13	8.79
S-3	Trucking Rough Stock to Shears & Hammers	263.04	44.72	28.93	86.80	52.61	18.41	21.57
S-4	Trucking Forged or Partly Forged Pieces	233.19	39.64	25.65	76.95	46.64	16.32	27.99
S-5	Loading Finished Forgings	118.20	20.09	13.00	39.01	23.64	8.27	14.19
S-6	Cutting and Handling Scrap	71.98	12.24	7.92	23.75	14.40	5.04	8.63
S-7	Foremen	394.45	67.05	43.39	139.16	75.89	27.61	47.33
S-8	Inspection of Product	214.17	37.81	23.56	47.12	23.56	10.71	21.41
S-9	Boiler Room Labor and Steamfitters	90.50		19.90	31.70	38.90		
S-10	Electrical Work	54.10	23.27	1.62	2.70	3.24	7.57	15.70
S-11	Oiling	29.50	6.49	3.54	5.90	7.38	2.06	4.13
S-12	Sweeping and Watching	59.52	17.86	7.74	13.09	6.55	5.35	8.93
S-13	Repairs to Buildings and Grounds	6.79	1.63	.48	1.35	1.56	.41	.95
S-14	Repair to Miscellaneous Tools and Equipment	94.09	22.60	12.24	18.80	21.60	5.65	13.28
S-15	Perishable Tools	37.60	9.03	4.88	7.52	8.65	2.26	5.26
S-16	Experimental Work	42.20	10.10	5.48	8.47	9.74	2.52	5.89
S-17	Moving Machinery	4.92	1.15	.64	.98	1.13	.30	.69
S-18	Miscellaneous Non-Productive Labor	31.64	7.59	4.11	6.33	7.27	1.91	4.43
	Totals	2437.45	501.32	343.96	689.24	505.48	139.72	257.73

however, which has a varied assortment of steam hammers board hammers and upsetters, can certainly not afford to use the percentage system.

The initial cost, operating charges, and repair bills for a board hammer are less than those for an equivalent steam

first obtained. This total overhead should be divided among the various forge shop departments, viz.: the forge shop proper, the die room, and possibly other allied departments, such as the heat treating department. The division among these departments is, compara-

*Paper read at the Drop Forge Supply Association Convention.

**Dominion Forge & Stamping Co., Walkerville, Ont.

tively speaking, a simple matter, as practically all of the overhead charges can be debited directly to one department or another. This division of the entire forge shop overhead among the two or three departments comprising that forge shop will not, however, be discussed. We will deal exclusively with the problem of dividing the forge shop proper overhead among the various groups of equipment within that forge shop itself. The word "Forge Shop" as used hereinafter will be used in the narrower sense of that term, meaning the sum total of productive equipment of the plant, such as hammers, upsetters, etc.

It is not necessary to separate one hammer from another of the same size in determining an hour rate. It is sufficient to obtain the overhead for a certain group of hammers, all about the same size, and to divide that total equally among the hammers of that group. A certain job might be set up in a hammer and due to no fault of that particular piece, the job might be held up considerably, due to breaking rods or other hammer troubles. It would not be right to discriminate against this piece on that account.

A record is kept of the total number of hours that the hammers in any group operate. A record is also kept of the number of hours that any particular piece of work occupies a hammer of any group. In figuring the amount of time that a certain piece occupies a hammer, all time consumed in setting and repairing dies is charged to that particular piece, as well as the number of hours the hammer was productively engaged on that piece of work. If, however, the hammer should be shut down on account of lack of power for several hours, that time should not be charged against the particular piece of work, nor should it be considered in obtaining the total number of hours that a certain group of hammers operated. It is compensated for by the smaller divisor used in obtaining the overhead at the end of the month.

We will assume that the accounting period under consideration is a month, and that the plant is operating day and night, with a total of possible working hours for the month of about three hundred and thirty. We will further assume a shop having a fairly diversified equipment. The use of the percentage system for the division of the overhead for this plant would, therefore, be very liable to play such havoc with the individual costs as to make it possible for the plant to lose money and at the same time make it difficult for the management to determine where the trouble lay. We are listing below the equipment of this hypothetical plant, with its six groups of different types of equipment.

- A—5 units, 1,000 lb. board hammers.
- B—2 units, 1,500 lb. steam hammers.
- C—2 units, 2,500 lb. steam hammers.
- D—1 unit, 5,000 lb. steam hammer.
- E—1 unit, 1½ in. upsetter.
- F—1 unit, 3 in. upsetter.

Taking for granted that the total factory overhead has already been apportioned among the various groups of hammers.

tioned among the various departments and that the correct amount has been charged against the forge shop proper, we next divide the forge shop overhead proper among the six groups contained in this hypothetical shop. It is evident that there are items of overhead which can be charged directly to a certain group of equipment. The time and cost department, for example, can keep a careful record of the repairs to the machinery of each group. There are other charges, however, the basis of which must of necessity be theoretical, and there will always be a difference of opinion as to whether the basis chosen for division in each case is the correct one. The writer has selected what seemed to him to be the proper basis of division

among the various groups of hammers.

Direct Charge.

S-1—Repairs to machinery.

Weight of Output.

S-2—Unloading rough stock — bar steel.

S-3—Trucking rough stock to shears and hammers.

S-4—Trucking forged and partly forged pieces.

S-5—Loading finished forgings.

S-6—Cutting and handling scrap.

S-7—Foremen.

Weight and Number of Pieces of Output.

S-8—Inspection of product.

Steam Consumption.

S-9—Boiler room labor and steam-fitters.

TABLE III.—NON-PRODUCTIVE PURCHASE AND EXPENSE ITEMS AS CHARGED TO MACHINE GROUPS.

No.	Item.	Total	A		B		C		D		E		F	
			5-Boards	Steam	2-1500 lbs.	Steam	1-5000 lbs.	Steam	1-Small	Steam	1-Upsetter	Steam	1-Large	Upsetter
1	Boiler fuel and water	747.55			164.46		261.64		321.45					
2	Electric power	195.58	84.10	5.87		9.78		11.73		27.38		66.72		
3	Material purchases	1568.47	372.83	201.95		310.69		367.30		93.21		217.49		
4	Insurance and taxes	121.64	29.19	15.81		24.33		27.98		7.30		17.03		
5	Furnace fuel	875.04	219.14	122.50		253.50		189.90		61.25		78.75		
6	Int. disc. and pref. div.	735.72	103.00	88.30		242.70		184.00		44.15		73.57		
7	Office expense	812.61	108.70	97.50		276.20		203.20		48.75		81.26		
Totals		5041.61	913.96	696.39		1878.84		1245.56		282.04		524.82		

sion for each of the overhead items. Everyone, however, is entitled to have his own opinion. It is very probable though, that the results finally obtained by different methods of distribution will not vary greatly, provided the theoretical basis of division selected is reasonable in each case.

There are two great classes of overhead charges to be divided. The first class is the nonproductive shop labor. The second class includes all office expenses and the great number of overhead material purchases, and miscellaneous expenses of all sorts. Besides these, there are also the charges for dies and

Electric Power Consumption.

S-10—Electrical work.

Steam and Electrical Consumption.

S-11—Oiling.

Floor Space.

S-12—Sweeping and watching.

Asset Value.

S-13—Repairs to buildings and grounds.

S-14—Repairs to miscellaneous tools and equipment.

S-15—Perishable tools.

S-16—Experimental work.

S-17—Moving machinery.

TABLE IV.—DIE ROOM MATERIAL, LABOR AND OVERHEAD ITEMS AS CHARGED TO MACHINE GROUPS.

Die material	Labor	Overhead	A		B		C		D		E		F	
			5-Boards	Steam	2-1500 lbs.	Steam	1-5000 lbs.	Steam	1-Small	Steam	1-Upsetter	Steam	1-Large	Upsetter
Die material	601.77	132.39			108.32		186.55		108.32		21.07		42.12	
Die labor	1024.86	225.48			184.17		315.71		184.17		40.39		71.71	
Overhead	1281.05	281.85			230.59		397.13		230.59		51.24		89.67	
Totals		2907.70	639.72	528.38		901.35		743.58		116.50		203.50		

depreciation. We will consider first the question of non-productive shop labor.

Non-Productive Labor Charge System.

Doubtless every shop has a non-productive labor charge system with various symbols for the various non-productive activities in the plant, such as trucking, repairs, inspection, etc. Some plants have many charging numbers for these non-productive activities, and other plants have not so many. It would appear that there is a middle ground which is detailed enough to give the management a proper grasp of their non-productive expenses without going into such detail as to make it cumbersome for the time and cost department to obtain the information. In this paper the writer takes the liberty of using his own system. The items are grouped according to the basis upon which they are later apportioned.

S-18 — Miscellaneous non-productive labor.

Referring to non-productive activities tabulated above, as stated before, there is an opportunity for discussion as to the basis of division used for some of these various charges. We will discuss several of these in detail.

All repairs to a machine are charged directly to the group to which that machine belongs. This is necessary for the repair charge is always an appreciable percentage of the total non-productive labor charged against the plant, running as high as 25 to 35 per cent. of that total. It is also very different for the different classes of equipment as is shown by table II.

The apportionment of all the material handling on the basis of the weight of output of the groups seem to be a rea-

sonable division. It is interesting to know that the sum total of the monthly charges for trucking when plotted against the monthly output of the plant are found to vary directly with the latter, which would indicate that the basis of division is theoretically correct.

Charging of foremen's time on the basis of weight of output may be open

Asset Value.
Material purchases.
Insurance and taxes.
Furnace Fuel Consumption.
Fuel oil or gas for heating furnaces.
Value of Output.
Interest, discount and preferred dividend.
Offices expenses.

on the amount of money tied up on a forging, whether that money has been expended for material, labor or overhead. The office expenses are also divided on this basis as this seems a fairer basis than either weight or an average of these two would be.

Die Room Charges.

We have scrupulously refrained thus far from any discussion of the die room. As mentioned before, the general overhead for the entire plant is first divided among the forge shop proper, the die room, and perhaps other allied departments. The actual die room overhead, is therefore, known. The value of new die blocks used per month and the die room labor charge for the month can also be found.

There is a great diversity of opinion as to the proper method of handling these die room charges. When a forge man accepts an order for a new piece, the customer is usually obliged to pay a die charge. If the order is a large one, or if there are repeat orders, new dies must later be made up, and these additional dies are made up at the expense of the forge man. The first dies really represent insurance on the part of the Forge Company against a cancellation of the order. After this first order is completed, or after the first set of dies is worn out, the forge man usually feels that he can trust his customer sufficiently to make further dies.

If a forge man will keep track of the actual dollars and cents received for new dies during the month and compare that with the charges against the die room for material, labor and overhead, it will be seen that the amount of cash received any one month is relatively small. This is particularly true in large shops with only a few customers who give big repeat orders. The writer feels the only safe way to handle the die room is to charge its entire expense for material, labor and overhead, directly against the forge shop itself. Undernoted are

TABLE V.—DEPRECIATION AS CHARGED TO MACHINE GROUPS.

Per month	1016.14	251.07	136.00	209.23	210.61	62.77	146.46
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to some argument, but a study of table I. would indicate that this is probably the most logical method of handling this item. A division on the basis of value of output would produce about the same result.

The division of inspection on the basis of weight and number of pieces of output is used rather than a basis of either weight or pieces alone. The former would place too great a burden on the large hammers, and the latter method would swamp the swift board hammers. An average of the two would, therefore, seem to be better.

Apportioning the boiler room labor and the steam-fitters' time on the basis of the steam consumption of the various units would be open to little argument. The same remark applies to the division of electrical power consumption. Oiling being required by both steam and electrically driven units, was divided on the basis of the average of the two. Sweeping and watching were apportioned on the basis of floor space. Under the heading of asset value are a number of non-productive activities, no one of which are comparatively large. It is probable that some of these activities could be divided on a more theoretically correct basis, but the amount involved is too small to justify the additional labor.

Non-Productive Purchase and Expense Items.

We will next consider the second class of overhead charges which include all

Referring to the above the division of boiler fuel and watercharges among the hammers on the basis of their steam consumption is a logical one. The apportionment of the cost for electric power on the basis of the actual power used per group is also theoretically correct.

The charge for non-productive material purchases and miscellaneous expenses is the most difficult one to apportion properly. It includes a multitude of miscellaneous purchases and expenses, such as:

Shop supplies of all kinds.
Office supplies.
Hand tools and perishable tools.
Oil, waste, compounds, gasoline, etc.
Repair parts.
Advertising and travelling expenses.
Telegrams and telegraph charges.
Company trucking.
Trucking by other companies.
Express charges.

The basis of division used for these expenses is open to discussion. Wherever it is possible to do so, individual purchases are charged directly to the proper group. A new cylinder, for example, purchased for a 5,000 lb. hammer, is charged directly to group D. After all possible charges, which may be handled in a direct manner are thus made, the balance is divided on the basis of the asset value of the equipment. Insurance and taxes are also divided on the basis of asset value.

TABLE VI.—OVERHEAD SUMMARY.

	A 5-Board Hammers 1280 Hours			B 2-1500 Lbs. Steam Hammers 517 Hours			C 2-2500 Lbs. Steam Hammers 520 Hours		
	Amount	Total	Rate per Hour	Amount	Total	Rate per Hour	Amount	Total	Rate per Hour
Non-productive labor	\$ 501	\$ 501	\$0.39	\$344	\$ 344	\$0.67	\$ 689	\$ 689	\$1.32
Expenses	914	1415	0.71	696	1040	1.35	1379	2068	2.65
Die material, labor and overhead	640	2955	0.50	523	1563	1.01	901	2969	1.73
Depreciation	251	2306	0.20	136	1699	0.26	209	3168	0.40
	D 1-5000 Lbs. Steam Hammer 260 Hours			E 1-Small Upsetter 225 Hours			F 1-Large Upsetter 200 Hours		
	Amount	Total	Rate per Hour	Amount	Total	Rate per Hour	Amount	Total	Rate per Hour
Non-productive labor	\$ 505	\$ 505	\$1.94	\$140	\$ 140	\$0.62	\$ 258	\$ 258	\$1.29
Expenses	1216	1751	4.80	282	422	1.25	783	1041	2.63
Die material, labor and overhead	523	2271	2.01	116	338	0.52	204	987	1.02
Depreciation	211	2515	0.93	63	601	0.28	146	1133	0.73

office expenses and the great number of overhead material purchases and expenses of all sorts. These are tabulated in the same manner as were the non-productive items, namely on the basis of the method of charging them against the various groups of equipment.

Steam Consumption.

Coal or other fuel used in boilers.
Water for boilers.

Electric Power Consumption.

Electric power bill.

The fuel oil or gas used in the furnaces is apportioned on the basis of the amount of fuel used by the furnaces of each group. To be sure the amounts will vary with pieces of different weights, but an average may be found which will be sufficiently accurate for all cases within one group.

Interest, discount and preferred dividend are apportioned on the basis of the value of the output. These are fundamentally borrowing charges and depend

shown the die room charges, and the basis according to which they are apportioned among the machine groups. The basis of division used is dependent upon the actual die material and die labor cost of the dies for each group.

Die Costs.

Die room material; die room labor; die room overhead.

Depreciation Charge.

There is another item which must be considered in properly determining the

hammer-hour overhead rate, and that is the depreciation charge. The depreciation charge is the depreciation charge against the entire factory. The hammer shop should carry the entire charge, as it is the only producer of an output which is sold. The value used was obtained by employing rates of depreciation recommended by a reliable firm of public accountants. This charge was divided among the various groups on the basis of their asset value.

Referring to Table I, it is probably interesting to know the manner in which the various percentages given there were determined. The methods were simple and can be used by any plant. It is no doubt true that the actual percentages may vary with different plants, but when the final results are obtained, they will probably not vary considerably.

Percentages for weight and number of pieces were determined by carefully tabulating a year's forging reports which showed the daily weight output and piece output of each group.

The steam consumption percentages were determined theoretically, the percentage being based on cylinder sizes with slight additions in the case of the smaller hammers to compensate for the more rapid cooling of the cylinders.

The electric power consumption percentages were determined by meter measurements. The power used by the trimming presses of each group was charged against that group.

The floor space allotted to each unit was not the actual floor space occupied by the unit alone, but by the unit and its tributary press and furnace.

The asset value for the machinery was taken from the company's records and from information obtained from the manufacturers of hammers and upsetters. Particular care was taken to be sure the prices were all for the same date. The varying prices of units during the past year or two would have produced very contradictory results if this care had not been taken.

The furnace percentage charges were obtained from a series of heating tests conducted on the furnaces of each group.

The value of the output was determined by tabulating in groups the value of the production as shown by a year's forging reports.

The percentages which were used to apportion the die room material, labor and overhead, represents an average of two preliminary sets of percentages. The first set of percentages was based on the value of the die blocks used by each group of hammers for a definite period of time, and the second set was based on the die room labor expended on the dies used by each group of hammers for the same period of time.

The forge department's records were consulted and one entire season's work was tabulated and arranged according to the group of machinery in which the work was done. A study was then made of the pieces in each group with a view of determining the average size of the die blocks used by each group. A study was next made of the number of the

average impressions per set of blocks and the average number of pieces made per impression. Knowing the value of the steel contained in these die blocks, the die block steel cost per piece was determined, and finally the cost per hour for die blocks was obtained, using the average number of pieces made per hour and the unit of that group as a basis.

In the same manner the die room labor was tabulated and arranged for one season's production according to the group in which the work was done. These calculations are really not as complicated as they look, and any shop can obtain the results with a, comparatively speaking, small amount of figuring. The percentages obtained by each of these methods were very nearly the same. As stated before, the percentages given in Table I. were obtained by averaging these two preliminary sets.

We have now considered all of the proper charges which enter into the computation of a system of hammer-hour overhead rates. We first showed the methods used for obtaining the amounts of these various items of overhead. We then apportioned among different groups these various charges in the case of an hypothetical shop consisting of six groups of different units. We have discussed in detail the basis of division of each of these and the methods by means

TABLE VII.—SAMPLE COST FIGURED WITH HAMMER HOUR BASIS AND PERCENTAGE BASIS.

	Hammer Hour System	Percentage System
Material	16.12	16.12
Productive labor	2.40	2.40
Overhead	20.34	7.20
	\$8.86	25.72

of which these percentages were determined. We will now consider actual figures.

A set of figures has been made up for this hypothetical shop, using as a basis data collected by the writer for different types of equipment during the several years back. It is probable that figures of this character will vary with the different shops, but the final results obtained should not vary greatly.

Table II. shows non-productive labor items as charged against the machine group on the basis of the percentages given in Table I.

Table III. shows the non-productive purchase and expense items charged against the machine group on the basis of the percentages given in Table I.

Table IV. shows the die room expenses charged against the machine groups on the basis of the percentages given in Table I.

Table V. shows the depreciation charged against the machine groups on the basis of the percentages given in Table I.

Tables II. to V., inclusive, should be perfectly clear, and anyone who wishes to check any of the figures can do so by obtaining the proper percentages in each case for Table I.

Table VI. is the final summing up of the data contained in Tables II. to V., inclusive. In order to simplify the figures, only dollars have been considered.

This tabulation shows the six different groups, the number of units in each group, the character of those units, and the total number of hours the hammers in each group operated. As stated before, the period of time under consideration would have made possible a total of three hundred and thirty hours per unit. From this it can be seen that the average efficiency of the equipment under question from a time standpoint was about 80 per cent. This is probably as high a percentage as can be obtained when a shop is operating both day and night.

The information is so tabulated that it is possible to see not only the total hammer-hour charge, but the effect that each of the four major non-productive activities has on this total hammer-hour rate. For example, the hammer-hour rate developed for the board hammer is \$1.80; of this, 39c is accounted for by non-productive labor. It is possible to go back still further and to note that in Table II. under non-productive labor, there is an amount of \$117.56 charged against repairs to machinery in the grand total of \$501, and debited to non-productive labor for board hammers. This indicates that 9c of the 39c charged to non-productive labor is chargeable directly to repairs to machinery. A careful analysis in this manner of all of the larger charges which go to make up the total hammer-hour rate should make it possible to effect economies in any shop.

Referring to Tables II. to V., inclusive, it will be noted that the sum total of the overhead charged against the forge shop proper was \$11,432.90. The productive labor for this period of time was \$3,800.00, which would produce a shop overhead, figured according to the old method, of 300 per cent.

We will now consider a definite piece, and figure the cost of same by means of the hammer-hour rate system and the percentage system with a view to noting whether there is any difference in the final results. This example is taken from an actual piece—an eyebolt weighing eight pounds, forged in the writer's factory. The costs of this part per hundred pieces are shown in Table VIII.

The material and labor charges are, of course, the same in both instances. The overhead in the case of the hammer-hour system was figured on the basis of a production of 270 pieces, made in nine hours in a 2,500 lb. steam hammer, the hammer hour rate of which was \$6.10 per hour. The overhead in the case of the percentage system was obtained by using a 300 per cent. overhead.

The writer has always maintained, that whereas a certain piece of apparatus may cost \$2.00 an hour to operate in a certain shop, the very same piece of apparatus may cost \$3.00 an hour to operate in another shop, or vice versa. This means that a certain forging may have a different cost in every factory, and that these costs may differ due to natural causes and not due to inefficiency or improper methods.

NEW METHOD OF ARTIFICIALLY LOADING GENERATORS FOR TEST.

IN making tests on hydro-electric plants, it is quite frequently found necessary to provide artificial loads for the generators, says a writer in *The General Electric Review*. In such cases it has been the general practice to use a liquid rheostat formed by placing the electrodes in either the forebay or the tailrace, according to convenience, or sometimes in a special tank with salt solution. Such an apparatus, besides having numerous troubles of its own, produces only a unity power-factor load; whereas the majority of generators are designed for operation at about 0.8 power-factor.

A scheme free from the objections to the liquid rheostat method was first made public in a paper on the Huronian Co. Power Development by Robert A. Ross and Henry Holgate, read before a joint meeting of the Mechanical and Electrical Sections of the Canadian Society of Civil Engineers, April 25, 1907. Since then the method has been used a number of times in various tests by R. A. Ross & Co., consulting and supervising engineers, of Montreal. Through the courtesy of J. Norman Smith, chief engineer of that company, the writer has been given the most important details from its experience; and these are now published for the benefit of any who may desire to use this method.

This same scheme was independently originated and successfully used by O. H. Ensign, Chief Engineer of the United States Reclamation Service, in testing the generators at the Cross Cut Hydro-electric Station, Salt River Project. With these exceptions, this method of loading generators does not seem to be as generally known as its merits justify.

The scheme is exceedingly simple, and consists merely in connecting another generator (when one is available), to the machine under test, with one phase reversed, so that the load generator runs in the opposite direction of rotation as a synchronous motor. When both machines are up to speed and are excited to full voltage, the gates of the wheel which is motoring are gradually opened until the required load is obtained, the wheel in this case acting as a water brake. The generator and motor fields may now be varied to produce any power-factor and voltage desired.

The following instructions prepared by R. A. Ross & Co. for the guidance of their men are of interest:

Instructions for Running Water-Wheel Generator-Motor Test

1—Transpose any two legs of the motor leads (this will reverse the direction of rotation of the motor; see Fig. 1. Say place B in A and A in B on the motor leads).

2—Close the main generator switches connecting the generator and the motor electrically together.

3—Excite both the generator and the motor.

4—Admit water to the generator wheel only, until both machines are turning over.

5—Note that the motor is operating in the reverse direction to that which it would operate as a generator.

6—Raise the voltage and the speed of the generator to normal by operating its field rheostat and by admitting water to the generator wheel.

7—Admit water slowly to the motor water-wheel to act as a brake, as required, to secure any desired load on the generator up to its wheel capacity.

8—Vary the field excitation on the generator and the motor to secure any desired power-factor.

9—The generator instruments will indicate the output of the generator; the instruments on the motor need not be taken into consideration.

10—If the exciters are directly connected to each generator and one exciter is not sufficient to excite the two machines, it will be necessary to reverse the exciter connection on the motor exciter to suit the reversal of direction of rotation.

11—The governor mechanism should be disconnected from the motor, as it might be damaged by reversal of rota-

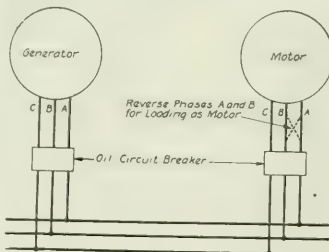


FIG. 1

tion, but an operator should be in attendance, to shut off the water to this wheel, in case of the circuit opening to the motor, when the water passing into the motor water-wheel would stop same, and reverse direction of rotation, causing it to speed up rapidly and possibly run away.

12—By actual operating conditions it has been found that quite a small gate opening on the motor water-wheel is all that is necessary to produce full load on the generator under test.

Troubles Experienced

A few of the troubles experienced by others are noteworthy. One most important point is to have the draught tube of the motoring unit filled with water before attempting to start; otherwise the hunting and surges set up by the wheel revolving against a load which is intermittent rather than steady may trip the oil circuit-breakers, or cause the machine to break from it.

synchronism. On starting, the motoring unit cannot be started from its own wheel, as it would then run in the wrong direction. Usually two duplicate machines can be started together from rest, as described in the foregoing instructions; viz., by exciting both fields, connecting the armatures together, and admitting water to the generator wheel until it starts. The low-frequency currents produced in the generator armature will then drag along the field of the motoring unit and the two machines will run in synchronism from the start.

Trouble may occasionally be encountered due to high static friction in the bearing of one or both machines. This would necessitate opening the generator wheel-gate so wide, in order to "break it from rest," that the resultant large amount of water would cause the generator to accelerate too rapidly and it would break from synchronism with the motor. This may be overcome, in some cases, by starting the machine as a plain induction motor; i.e., by not exciting the motor field until it is partly up to speed. If this is not successful, the gates of both units may be opened just enough to start them turning over, without switching them together. As soon as the units start revolving, the gates should be closed and field applied to whichever unit is necessary to make them come to rest at the same instant. Just before they stop they should be switched together, fields applied to both machines, and the generator gate opened until they start together. This procedure will eliminate the high static bearing friction and no difficulty should then be experienced in getting started.

It is doubtful if much trouble will be encountered with horizontal units; but vertical machines, especially those equipped with Kingsbury or plate-type thrust bearings, are likely to be obstinate. It should be particularly noted that Kingsbury bearings are usually designed for one direction of rotation only, and some care must be taken when applying the test herein described to machines equipped with them.

The question may be raised as to what effect this method of testing will have on the water-wheels; whether impelling them directly against the flow of water will not result in strains and distortions that may be injurious. The writer has referred this subject to a number of the most prominent water-wheel builders in the United States, and very few have cared to make any very definite statements on this point. The consensus of opinion, however, seems to be that there is little question of harmful stresses in high-head wheels, but there may be some doubt as to low-head units. The writer would recommend conferring with the water-wheel builders in each individual case where this method of test is being considered. It is believed that when this method shall have become better known and more generally used, wheel builders will be less conservative about approving

Merits of Some Recent Developments in Air Pump Design*

By E. Jones

In this paper there are discussed the merits of some of the more recent developments pertaining to a piece of equipment installed in most power stations. An air pump is a very essential part of the condensing plant, without which any of our modern steam-operated power stations or, indeed, any machines used for the generation of power, employing steam as the working fluid, would be practically of no value except for very small units.

IT may be advisable at the outset to run very briefly over the various types of condensing plant at present in use, in order to arrive at the cause of inventors turning their attention to the design of new types of air pumps. There are five types of condensers, viz., evaporative, ejector, barometric, jet, and surface.

Evaporative Condenser

Evaporative condensers are expensive because of the large cooling surface re-

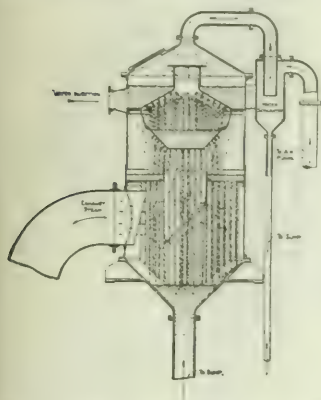


FIG. 1. TYPICAL BAROMETRIC JET PLANT.

quired to condense the steam, and are only adopted when it is almost impossible to obtain water which can be utilized for cooling purposes. Steam flows inside of the tubes, which are grouped together in sections, and all joined up to the header pipes or steam mains. Cooling is obtained by air, and the radiation effects caused by allowing a stream of water to continually pass over the tubes. There are a great many joints in the apparatus which tend to make this type of condenser unsuitable for modern requirements.

Ejector Condenser

The ejector condenser deals with the steam and air without the use of an air pump. The steam to be condensed is delivered into the condenser body, which is fitted with a specially designed series of nozzles. The cooling water enters under pressure at the top of these nozzles, condensing the steam and entraining the air and incondensable gases, the whole passing down the discharge pipe. Despite the simplicity of these condensers, they

do not appear to have found general favor.

The foregoing types would appear to be still in the embryo stage, and open up large fields for further investigation.

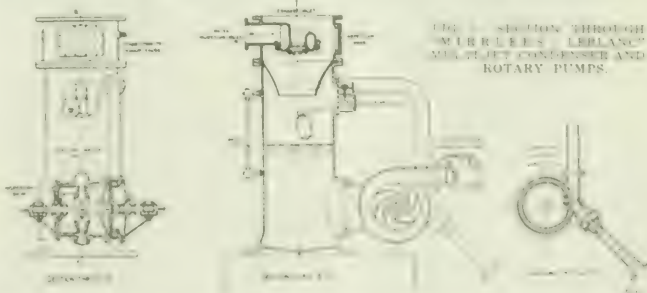
Barometric Condenser

The barometric condenser is, of course, a jet condenser, in which the cycle of operations of the cooling water is just the reverse of the cycle used in the low-level jet plant—that is to say, the cooling water is pumped into the condenser and flows away by gravity down the tail pipe. It is, therefore, necessary to place this condenser at a height above the level of the water in the outlet sump, equal at least to the height of the water column which could be supported by the vacuum plus a marginal head of at least 3 ft. or 4 ft., to allow for pipe friction and to cause flow of the water. This very often means that the condenser has to be placed on the top of a building, or on a staging specially erected to accommodate it at the required height. Occasionally cases crop up where a barometric plant can be installed at the ground level of the engine room, but this means that the cooling water is at a level of at least 34 ft. below, and, therefore, if the pumping plant is of the centrifugal type, it is necessary to have a pump house considerably nearer the cooling water level, which means that the plant is not compact or self-contained. This is a decided disadvantage. Another point which does not tend to add favor to the barometric plant when placed at a distance above the exhaust branch of the prime mover is the long length of exhaust steam main,

superseded by the low-level jet plant. At the present time the majority of condensing installations are either of the jet or surface type, and the choice generally depends on local conditions and sometimes by the amount of money available for the scheme on hand. With the low-level type of jet plant, the cooling water is drawn into the condenser which is under vacuum. The water and steam mix freely, and the latter is condensed, and the cooling water and condensate are extracted from the condenser by means of a pump which is invariably, as far as the writer's experience goes, of the centrifugal type, specially designed to meet the requirements of drawing water from a space under a very low absolute pressure and discharging at atmospheric pressure or against an external head. The air and gases which are not liquefiable under the conditions obtaining in the condenser, are dealt with by some type of dry air pump. The advantages of this type of plant over the barometric jet plant are that it can be placed immediately below the turbine, thereby reducing the possibility of air leaks. The whole equipment is self-contained and compact, and can be operated and regulated at very short notice by the engine-room attendant. Fig. 1 and 2, show a typical barometric jet plant and low level multiple jet plant of the Leblanc type.

Surface Condenser for Marine Work

Perhaps the most important type of condensing plant is the surface condenser, inasmuch as it is used almost invariably for marine installations, and in



which is not only expensive, but often a source of trouble, due to the greater number of joints, which have to be kept perfectly air-tight.

Low Level Jet and Surface Condensers

It is chiefly for these reasons that the barometric jet-condensing plant has been

a lesser degree for large power units, the reason for this being that the condensate is an important item, as it supplies a source of excellent boiler feed-water and also under the same external conditions, the surface condenser is generally less than for a jet plant. The design of modern

*From a paper read recently before the Institution of Engineers and Shipbuilders, Glasgow, Scotland.

surface condensers, as far as the condenser itself is concerned, has not changed materially for the last 30 years or so, so that there is no need to go

are as follows:—Steam quantity 40,000 lbs. per hour, vacuum $28\frac{1}{2}$ inches (barometer 30 inches)—95 per cent. of the barometer, cooling water 60 deg. Fah.,

it is clear that a reduction of from \$2,500 to \$3,000 should be possible in the case given above. This would bring the cost ratio of the surface plant, when compared with a multi-jet plant, from 1.57 to about 1.3.

With the earliest types of surface condensing equipment, it was usual to use one pump for removing both the condensate and air from the condenser. This pump was known as a "wet" air pump, and a good example of this type is the Edwards air-pump, one of the most efficient of its class. It is shown in section in Fig.3. The chief advantages of this type of pump are:—Low power required for driving; positive action and consequent stability; ability to cope with excessive air leakages. While the Edwards pump is still an excellent pump for units up to, say, from 3,000 to 4,000 k.w., it must be remembered that, with the ever-growing size of power units, its disadvantages should be kept in view. For large units with Edwards pumps, it

Type of plant.	Consisting of—	Approximate net weight of apparatus.	H.P. required to drive condenser and auxiliaries.	Present day costs.	Equivalent ratio.
Barometric.	Condenser, staging, air-pump, injection pump, driving motor, switchgear, air and fuel piping, main-exhaust piping and sluice valve, auto-exhaust valve. Complete erection.	40 tons.	89 H.P.	\$2,700	1.286
Low level jet.	Condenser, water-extraction and air-pumps, driving motor, switchgear, main sluice-valve, adapting and expansion pieces, auto-exhaust valve. Complete erection.	22 tons.	87 H.P.	\$2,100	1.00
Surface.	Condenser, rotary air-pump, extraction pump and circulating pump mounted on common bedplate with driving motor and switchgear. Necessary interconnecting pipes, main exhaust steam-sluice-valve, expansion piece, adapting piece, automatic atmosphere-valve. Complete erection.	30 tons.	78 H.P.	\$3,300	1.571

FIG. 2a. RELATIVE COSTS AND REQUIREMENTS OF THE FOREGOING THREE TYPES OF CONDENSERS.

further into details on this point. The cooling water is usually supplied by means of a centrifugal pump, except in cases where a syphonic action can be utilized or where the existing pumping plant is capable of taking care of the requirements of the condenser. A condensate pump is necessary to deliver the condensate from the condenser to the boiler feed-tank, and a dry air-pump to deal with the air and unliquefiable gases which find their way to the condenser. Alternately, an Edwards air pump can be adopted to deal with both the condensate and air. If the disposition of the various parts of the installation demand it, a hot-well will also be required. The above table may be of interest in noting the relative costs and requirements of

prime mover, high pressure steam turbine. For the barometric plant, 25 inch has been added to the vacuum to allow for the drop between the turbine-exhaust flange and the condenser. It should be noticed here that under the present abnormal conditions, surface condensers are in a practically unfortunate position, owing to the cost of the materials used for the tubes and tube plates, which is approximately 27½ per cent. of the value of the whole equipment. The price of tubes to-day is 38 cents per lb., whereas, in 1914, just prior to the commencement of the war, the price was 15 cents per lb., so that the increase in the cost of tubes is 240 per cent., and the increase in the cost of plates is approximately the same. Therefore, if times were normal, surface-

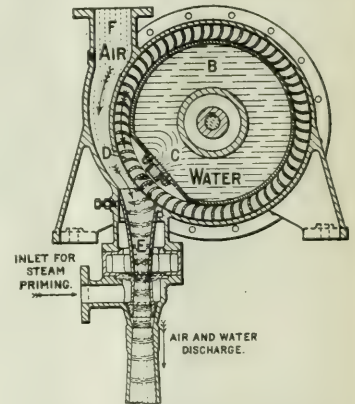


FIG. 4. "LEBLANC" ROTARY DRY AIR PUMP.

is necessary that they should run at a very low speed, and consequently they are very cumbersome, and take up a large amount of floor space. With jet plants, the Edwards pump is sometimes used as a dry air-pump. It is necessary, of course, to provide a small quantity of water for sealing purposes. Volumetric efficiency in this pump varies considerably with the degree of vacuum required, and decreases as the vacuum increases from about 50 per cent. at $3\frac{1}{2}$ inches absolute pressure to 18 per cent. at 1 inch absolute pressure.

Dry Air Reciprocating Type Pump

Another system is that in which a dry air-pump of the reciprocating type is used to remove the air and uncondensed gases, and a separate pump to remove the condensate. The advantages and disadvantages of this system are the same as for the Edwards air pump, but the efficiency is rather better. Previous to the introduction of the steam turbine, condensing plant equipments were furnished with air pumps of one or other of the types mentioned above, but as soon as the turbine became a commercial pro-

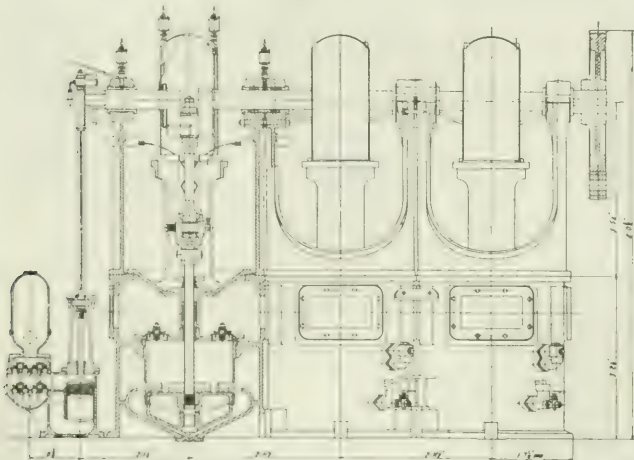


FIG. 3. SURFACE CONDENSING EQUIPMENT SHOWING SECTION THROUGH "EDWARDS" AIR PUMP.

the last three types of condensers which have been considered.

The conditions which have been assumed are the same for each case, and

condensing equipment would appear in a much better light, and although it is not proposed to suggest an accurate figure for surface plant with tubes at 15 cents,

position, it was necessary to look for a type of pump having features specially adapted to its requirements. With turbine installations, it is essential to use a high vacuum in the condenser, whereas

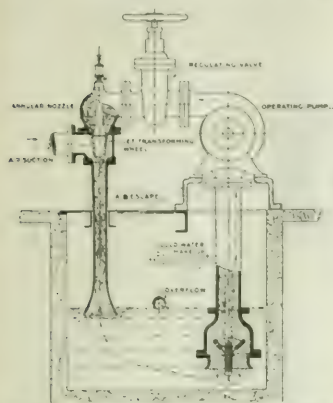


FIG. 5. HYDRAULIC VACUUM PUMP ON EJECTOR PRINCIPLE.

with steam engines of the reciprocating type a vacuum of more than 26½ inches was seldom required. In fact, it is questionable whether using a higher vacuum than 26½ inches would not be considered a disadvantage. With the turbine, however, a vacuum less than 27 inches is rarely asked for, and sometimes the specified figure is as high as 29.25 inches with the standard barometer reading of 30 inches.

In considering these figures, due allowance must be made for the altitude of the place. The most economical vacuum for a turbine installation depends on a variety of things, and each case has to be considered on its merits. On reference to steam tables it will be seen that an increase in vacuum from 27 inches to, say, 29 inches, other conditions as air leakage remaining the same, necessitates an increase in the capacity of the air pumps from 1.00 to 3.25, which for a large installation with Edwards or reciprocating dry air pumps is a very serious

cessful. The general design of these pumps is much the same, in so far as they use a certain quantity of what is termed "operating water," for which various devices have been invented to cause this water to move in such a manner as to entrain the air from the condenser and discharge it to the atmosphere.

Leblanc Rotary Dry Air Pump

Perhaps one of the best known rotary dry air-pumps is the one invented by Prof. Maurice Leblanc. It has been used to a very large extent all over the world and its action is shown in Fig. 4. This pump is capable of maintaining a very high vacuum, and for this reason, coupled with the fact that it is very simple in construction and not likely to get out of order, it has been largely used

The power required to drive these pumps is rather higher than that required for an Edwards or other good type of reciprocating air-pump, and consequently a good deal of attention has been paid recently to another type of pump which would incorporate the simplicity and compactness of the rotary pump and the low-power consumption of the Edwards and other reciprocating pumps. The general trend of thought seems to have been in one direction, and there are now on the market, and in commercial use, air-pumps operating on the ejector principle. Nearly all the leading condenser manufacturers now construct air-pumps of this description.

Worthington Hydraulic Vacuum Pump

The Worthington Pump Co. manufacture a patent hydraulic vacuum pump on

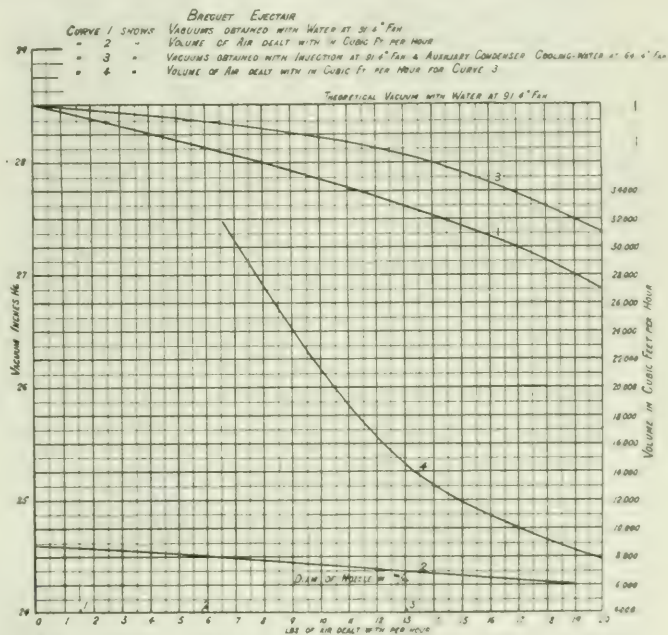


FIG. 7. PERFORMANCE DIAGRAM OF "EJECTAIR" OR EJECTOR AIR PUMP.

for turbine installations. It cannot be claimed for this pump—or indeed for any type of rotary air-pump—that it can successfully deal with an excessive air leakage, but consideration will show that this quality is not essential in the case of turbine installations where air leakage is reduced to a minimum by the adoption of steam or water-sealed glands where the shaft passes out of the turbine casing. With a surface-condensing plant, it is only possible for air to be brought into the system by the feed-water and carried over with the steam, or by leaking in at the joints. With jet plants, the air brought in with the injection water has to be allowed for in addition to the above, and it is for this reason that the air-pump on a jet plant requires to be larger than that for a surface-condensing plant doing the same steam duty.

the ejector principle, as illustrated in Fig. 5, which consists of the injection head, the air-suction chamber, the rotary wheel, and the throat and tail pipes. The operating water passes between two nozzle rings, and the cone of water passes between the body of the wheel and the outer sleeve, impinging on the inclined surfaces of the vanes, thus imparting a rotary motion to the wheel. To operate the pump, it is necessary to provide a certain amount of sealing water, which is supplied from a tank situated as convenient as possible to the pump. The sealing water takes up a certain amount of heat from the air and water vapors withdrawn by the air-pump, and a proper arrangement is provided for withdrawing a certain amount of this water by means of a by-pass connection on the operating pump discharge,

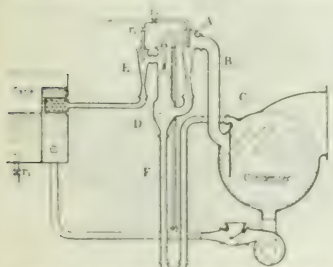


FIG. 8. EJECTOR AIR PUMP CONSISTING OF TWO EJECTORS WORKING IN SERIES.

matter. Hence it is that various types of rotary pumps, which are specially suitable for dealing with large volumes of air at low tension, have been designed since the adoption of the steam turbine, several of which have proved very suc-

this by-pass being fitted with a controlling reflux valve. The quantity of water withdrawn in this manner is replaced by make-up water drawn from the circulating inlet piping or an independent supply, thus cooling the water used in the cycle of operation. This apparatus is doing regular service on one of the turbo-

stability of the plant, and also renders it more flexible.

These ejectairs are designed for working with steam pressures at 55 lbs. per square inch or above, and, with a special arrangement of nozzles, lower pressures can be used in the primary ejector, although the advantage of this is not ap-

Monsieur Maurice Leblanc. It is the outcome of many months of arduous research work, during which time innumerable difficulties were surmounted by the inventor, with the result that a really first-class ejector air-pump has been evolved. Figs. 8, 9 and 10 show the general layout of the apparatus.

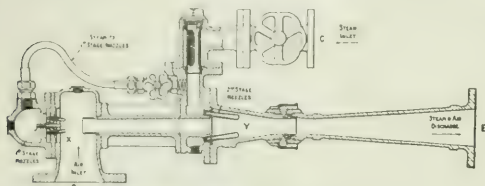


FIG. 8. "LEBLANC" EJECTOR AIR PUMP—SECTION 1.

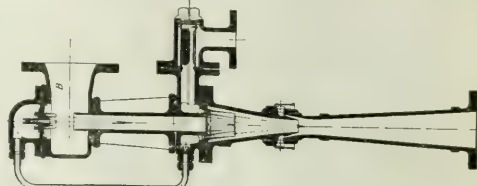


FIG. 9. "LEBLANC" EJECTOR AIR PUMP—SECTION 2.

alternator groups at the Glasgow Corporation power station at St. Andrew's Cross. A number of installations have also been supplied to other concerns.

Willans-Muller Ejector Air Pump

Willans & Robinson, of Rugby, manufacture the Willans-Muller ejector air-pump, which is operated by the circulating water, either on the series or shunt system. With the series system, the whole of the circulating water passes through the ejector before entering the condenser. With the shunt system, only a portion of the cooling water passes through the ejector, which, after use, is returned to the pump suction or the source of supply. A third method of operating this ejector is by the separate pump system, in exactly the same manner as described with reference to the Worthington pump. The Glasgow Corporation have a set of this apparatus at work at Pin-k-ton Power Station, and good results have been obtained, and a second set is just being installed at St. Andrew's Cross.

Hick, Hargreaves "Ejectair"

Another type of ejector air-pump is that manufactured by Hick, Hargreaves & Co., Bolton, under license from the Maison Breguet, Paris, which is really two ejectors working in series with an auxiliary condenser placed between the first and second stage of the ejectors. A number of these air-pumps, termed "Ejectairs," have been supplied or are under construction for the French navy. Referring to Fig. 6, it will be observed that the primary ejector is placed in direct communication with the main condenser, and extracts the aerated vapor, being operated by a single steam jet or nozzle. The mixture of steam and partly compressed vapor is then discharged to the auxiliary condenser, and the water returned to the main condenser to be dealt with by the extraction pump. The second stage ejector is coupled up to the auxiliary condenser, and draws the air away, discharging it to the feed-tank. An automatic air-inlet valve is fitted to the auxiliary condenser, to regulate the absolute pressure therein. It is claimed that taking air from the atmosphere in this manner materially assists the

parent if it is impossible to work the other ejector under the same conditions, neither is it clear whether this can be accomplished or not.

The curves, Fig. 7, show the performance of an ejectair. Steam to the ejectors had an absolute pressure of 125 lbs. per square inch, and the steam consumption is given as 194 lbs. per hour, of which 129 lbs. are recoverable. The apparatus, worked in conjunction with a small jet condenser, dealing with 94 gallons of injection water per minute.

Curve 1 gives the vacuums obtained with water leaving the condenser at a temperature of 91.4° Fah. (33° C.), and the auxiliary condenser out of action; Curve 2 the volume of air dealt with in cubic feet per hour; Curve 3 the vacuums obtained with given air leaks, and the water leaving the main condenser as for Curve 1, but with the auxiliary condenser supplied with cooling-water at 66.2° Fah. (18° C.), and Curve 4 the volumes of air dealt with under the same conditions. It was calculated that the air coming in with the injection-water and at leaky joints amounted to 1.102 lbs. per hour (.5 kg.).

The pump is arranged to work in two stages, and the steam is admitted to the second stage of the ejector by opening the stop valve. Immediately it is opened, steam fills the annular space behind the nozzle plate, and finds its way into the throats of the group of nozzles attached to this plate; it then passes along the steam pipe which supplies the first-stage nozzles, which are also attached to a nozzle plate. The supply of steam in this set of nozzles is controlled by the stop valve on the steam-supply pipe. The pump is connected to the condenser at the branch, which is the air-inlet branch.

At the entrance to each of the steam spaces, fine wire-gauze strainers are fitted to prevent any foreign matter which may have primed over with the steam from the boilers, from entering the nozzles, thereby intercepting any stoppage in the nozzle throats, and consequently a loss of vacuum. These nozzles are efficiently locked to the nozzle plates. The mixture of air and steam is discharged at the mouth of the divergent cone, and led away to the boiler feed tank, so that the heat units contained in

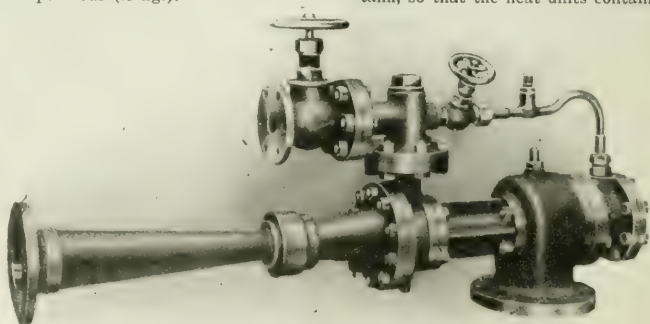


FIG. 10. "LEBLANC" EJECTOR AIR PUMP—EXTERIOR VIEW.

Leblanc Ejector Air Pump

The British Westinghouse Electric & Mfg. Co., Manchester, and Mirriless Watson Co., Glasgow, manufacture an ejector air-pump, under license from the Societe Anonyme Westinghouse, Paris and Le Havre, which is another invention of

the operating steam can be reclaimed by heating the feed-water. To start the pump to work, it is only necessary to open up the steam valve, and the vacuum will at once commence to increase in the condenser or other vessel to be evacuated. When the vacuum gauge becomes sta-

tionary, the second-stage steam-inlet valve is opened up to bring the vacuum to a maximum. A very important feature in this pump is the absence of moving parts. The simplicity of the apparatus is even more remarkable than that of the Leblanc rotary pump.

Advantages of Ejector Air Pump

The advantages claimed are as follows:—Extreme simplicity; the small amount of energy required for operating purposes; the high efficiency obtained; ease with which starting can be effected, and the small amount of attention required whilst at work; ability to produce the highest possible vacuums; stability. In scanning these claims we can pass over the first, which has already been mentioned and is obvious; there are simply two steam valves to open. The second deserves some consideration. The operating steam in passing through the nozzles decreases in pressure, and consequently in temperature, and also, after passing through the nozzles, does work in accelerating the velocity of the air, increasing its temperature and compressing it. There is also a small amount of heat lost, due to friction in passing through the diffuser portion of the ejector, which might be considered negligible. Beyond this, the whole of the heat in the steam can be utilized to heat up the boiler feed-water, and in order to obtain full benefit from the apparatus, it is highly desirable to use the discharge from the ejector for heating purposes of some description. Thus, both the steam and air can be made to do useful work. In view of this, it must not be forgotten that when an ejector of this type is specified as requiring so many pounds of operating steam per hour, this is only the apparent quantity, the actual quantity is really far less, since the great majority of heat units in the steam are still available for further work. The actual heat units recovered can easily be calculated from steam tables, since it is known that the steam and air leave the ejector at a pressure of from 10 to 12 lbs. per square inch by gauge.

Auxiliary Condenser Not Required

It will be observed that with a Leblanc multiejector, an auxiliary condenser is not required, and in this respect it differs materially from the "Breguet" ejector. The employment of an auxiliary condenser has the disadvantage that the total heat units of the steam used in the first-stage ejector, which amount to an appreciable percentage of the total heat units used on the whole apparatus, are dissipated and lost. The makers give this percentage as about 33. Another reason for dispensing with the auxiliary condenser will be apparent from the following:

In all steam-operated ejectors, one of the difficulties that have to be contended with is the fact that the steam leaves the nozzles at a velocity varying from about 3,000 to 3,600 feet per second, while the velocity of the fluid to be entrained is practically nil. This is the cause of considerable loss of efficiency in any ejector, but if an auxiliary condenser is used, the de-

fect is doubled, because the velocity of the fluid to be entrained, which has been imparted to it by the operating steam during its passage through the first-stage ejector, is dissipated and lost as soon as it enters the condenser. The cooling water used on the auxiliary condenser has to be dealt with by the condensate pump, thus increasing the power absorbed by the plant. When working with surface condensers this water must be of good quality, as it has to be returned to the boilers.

The third claim relates to efficiency. It is well known that ordinary single-stage



FIG. 11. STEAM NOZZLE DIAGRAM.

ejectors only work well when the compression ratio is as 1 : 7, and it is partly for this reason that the Breguet Co. have introduced the auxiliary condenser, so that the vacuum obtaining in this condenser is about 25.6 inches with the barometer at 30 inches, the compression being approximately as 11 : 76, or roughly, 1 : 7. The overall efficiency of this plant is, therefore, apparently still further reduced, because air is admitted from the atmosphere into the auxiliary condenser which is under a vacuum of 25.6 inches, and this, together with the air from the condenser, has also to be ejected by the secondary ejector to the atmosphere.

When Professor Leblanc set out to design his ejector he foresaw the possibility of using an intermediate condenser, but he also appreciated its disadvantages, and decided to do without it if at all possible. At the same time, he knew that it was essential to use two stages in order to get a stable and efficient ejector. With this end in view, certain steam nozzles were designed on the lines of the

formulae of Professor Rateau, and the action of the steam issuing from these nozzles when under high vacuum was directly observed. The result is shown by Fig. 11. The steam issuing from the mouth of the nozzle expands and contracts alternately, ultimately assuming a section of constant area. It was found that a number of these nozzles grouped together gave far better results than a single nozzle of the same throat area as the group of nozzles.

Number and Size of Nozzles

The reason for this is to a large extent due to the fact that the alternate increasing and decreasing of the cross sectional area of the steam stream is minimized by the contact of one steam stream with the next, when groups of nozzles are employed, and this helps to considerably increase the surface available for the entrainment of the air and gases. This entrainment is carried on mainly by friction, and it will be seen that if an appreciable amount of gas has to be dealt with the frictional surface exposed to the gas has to be as large as possible. It is also inversely proportional to the density of the gas or fluid. The number and size of the nozzles depends entirely on the space available in the diffuser, and keeping within the limits of workshop practice.

The smallest number employed by the Mirreles Watson Co. is three, each of which has a throat diameter of 1 mm. These are first-stage nozzles. On the largest size of pump, and in the second stage the number of nozzles is 30, and these have a throat diameter of 5.2 mm., when using operating steam at 90 lbs. per square inch. Professor Leblanc, in his paper of 1911 to L'Association Technique Maritime, says that "the operating steam entrains the air by friction. During entrainment it is the velocity of the steam which is utilized, and not its kinetic energy." Calling M the weight of operating steam used per second, V its velocity at the outlet of the nozzles, m the weight of air drawn in per second, and W the velocity of the mixture of air and steam, then $MV = (M + m)W$.

The ratio of kinetic energy, $\frac{mW^2}{2}$ of the

air drawn into the kinetic energy, $\frac{MV^2}{2}$

contained in the operating steam as it comes out of the nozzles, can, therefore, be stated as

$$\frac{mW^2}{2} \div \frac{MV^2}{2} = \frac{m}{M} \cdot \frac{W^2}{V^2} = \frac{m}{M} \cdot \left(\frac{M + m}{M} \right)^2$$

so that when $\frac{m}{M}$ is 1, $\frac{1}{2}$, 1-3, $\frac{1}{4}$, 1-5

$$\frac{m}{M} = .25, .222, .187, .160, .130.$$

This shows that if the utilization of the kinetic energy is to be the basis of the design, then for maximum efficiency it is necessary to bring the ratio

Air dealt with as near to unity
Operating steam used as possible

M. Leblanc continues:—"We tried to diminish the loss of kinetic energy by producing at the entrance of the diffuser a higher vacuum than was necessary, so that the fluid drawn in came in contact

Superheating the operating steam, although so useful for turbine work, is, however, not good for an ejector, because it is more difficult to effect compression in the diffuser which outweighs the advantages obtained in the nozzles. The next scheme was to use hot water in the nozzles, but this likewise proved unsuccessful."

Entrainment by Friction

After numerous other trials, it was decided that entrainment by friction was most economical, and various types of diffusers and different groupings of nozzles were experimented with, until the present ejector, as shown in Figs. 8, 9 and 10, was decided to be the most suited for condenser work. To go through the various stages in detail which led up to this design would take up too much time. With the form of ejector adopted, it has been found that the

efficiency of the nozzle is on an average 85 per cent., whilst that of the diffuser is 70 per cent. It will be seen that this ejector agrees very well with the ideal ejector which Prof. Leblanc had in his mind. The first stage, which consists of a small group of nozzles, serves a triple purpose, inasmuch as it effects a certain amount of compression heats up the entrained air, and gives it considerable velocity, and consequently an increase in momentum. The second stage has a larger number of nozzles, and it is here where the major portion of the work is done, the air being compressed from approximately 26 inches vacuum up to something more than atmospheric pres-

sure. To be more accurate, the steam used in the first stage is about 5 per cent. of the total.

High Vacuum Results

In support of the fourth advantage which this air-pump is supposed to possess, the following figures were obtained on the French torpedo-destroyer Boutefeu. The turbines were stopped, but steam was on the glands. The volume to be evacuated was about 635 cubic feet. After one minute, the vacuum was 6 5-16 inches, two minutes 15 inches, three minutes 22 13-16 inches, four minutes 25 9-16 inches, five minutes 26 3/4 inches, and six minutes 27 9-16 inches. The theoretical vacuum corresponding to the temperature of the water 67.1 deg. Fah., viz., 28 3/4 inches, was attained in 11 minutes. It was also arranged later to allow certain known air leakages to enter the condenser. With a 5 mm. nozzle which passes 36.2 lbs. of free air per hour, the vacuum dropped only 3/8 inch. With a 15 mm. nozzle, which is equivalent to 326 lbs. of air per hour, the vacuum was 21 1/4 inches. With an inch cock full open it took 11 minutes for the vacuum to fall to 12 1/4 inches, at which figure the mercury column remained steady. On closing the regulating valve below the nozzle,

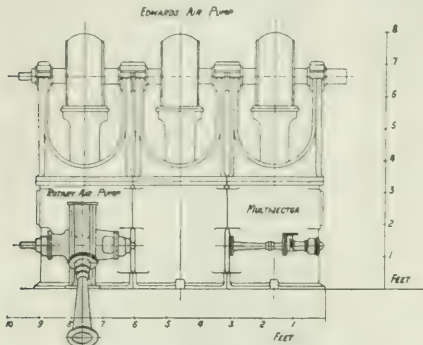


FIG. 12. RELATIVE SIZES OF "EDWARDS," ROTARY, AND MULTIJECTOR AIR PUMPS FOR SAME STEAM DUTY. WEIGHTS 20,832 LBS., 4,480 LBS., 97 LBS. RESPECTIVELY.

with the operating steam with a considerable velocity. If the efficiency of the diffuser could be brought almost to unity, we could add considerably to the over-all efficiency, but this has been found to be impracticable. Following on this, it was suggested to use puffs of steam after the manner of steam coming out of locomotive chimneys, but the complications involved in making arrangements for stopping the inlet of air during each puff were such that it would have been easier to use a centrifugal compressor. Afterwards we tried to compensate for the bad efficiency due to frictional entrainment by transforming heat into kinetic energy in the nozzles.

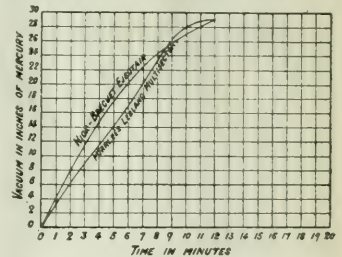


FIG. 14. DIAGRAM OF TIME TAKEN TO START UP A "HICK-BREGUET" EJECTOR, AND A "MIRRELES-LEBLANC" MULTIJECTOR.

the vacuum at once rose and attained the maximum almost immediately.

There is a central station near Glasgow where this type of apparatus is at work with a multi-jet condenser. Sometimes when changing machines they are liable to partially lose their water for a minute or so, but none of the staff ever have to trouble about the ejectors for, as soon as the water comes back again, the vacuum at once builds up, and the set is never shut down through failure of the air-pumps. As a matter of fact, in the case above stated, it is highly probable that during the period that the water supply to the condenser is very small, there is an air passage between the water spaces of the other condensers in the station and the multi-jet plant which would allow of a very excessive quantity of air getting into the condenser on load. This also shows that stability, the sixth claim, is another salient point.

That high vacuum can be obtained is proved by the fact that this apparatus is now being used in the French navy and mercantile marine, as well as on some land installations for refrigerating pur-

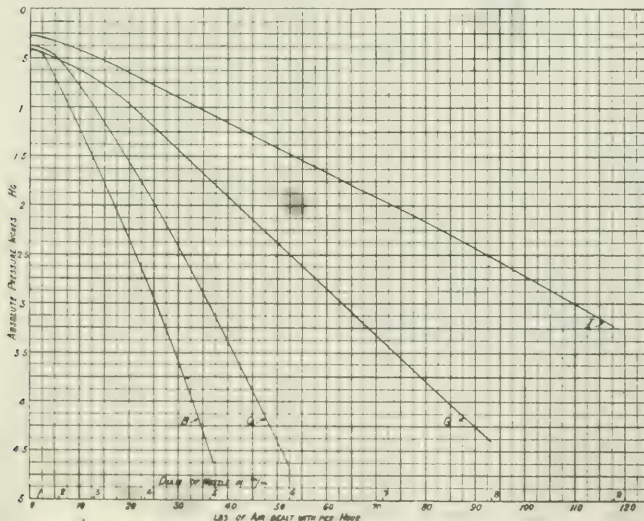


FIG. 15. AIR DEALING CAPACITY OF VARIOUS "MIRRELES-LEBLANC" MULTIJECTORS.

poses, and installations are at work where the maximum vacuum obtained is within 1 mm. of the barometer. For condenser work the best results obtained

pumps, particularly as in such factories the exhaust steam can generally be utilized to the fullest advantage on other processes. It may be advisable to point

that of a Mirreles-Leblanc multijector.

Figs. 15 and 16 show an application of Leblanc ejectors for refrigerating purposes. The arrangement is that supplied for magazine cooling on the French cruiser "Souffren."

There is no doubt that considerable improvements have been effected in air-pump design during the last few years, nevertheless there is still room for much further progress, and it is to be hoped that when hostilities cease and the British engineer has time once again for research work of this nature we shall have to drop all our present-day notions of efficient air-pumps for a type which will compel all others to become obsolete.

No. 18 M. J. Condensing Plant with motor-driven Water Extraction Pumps. 1 Size "6" and 1 Size "1" Multijector Air Pump installed at the Scottish Central Electric Power Co., Ltd., Bonnybridge.

Duty—50,000 lbs. steam per hour
Vacuum—28.5" (Bar 30")
Injection Water—3,800 Gals. per min., Temp. 65° F.
Air Pump Capacity—34 lbs. air per hour with guaranteed vacuum and water temperature.
Large Ejector to operate condenser alone on loads over 4 and up to 4 full load
Small Ejector to work alone on loads of 4 full and under
Both Ejectors to work on loads over 4 full load

Time	Load			Vacuum			Extraction			Water			Air Pump		
	W.G.	Ames	F.F.	W.G.	Ames	F.F.	W.G.	Ames	F.F.	W.G.	Ames	F.F.	W.G.	Ames	F.F.
8.45 A.M.	6350	130	-76	1050	28.1	28.2	20.8	120	150	152	43	70	4	62	480
11.0 A.M.	6350	265	-7	2000	28.5	28.5	20.00	122	130	152	43	70	4	62	
12.0 A.M.	6350	280	-7	2150	28.5	28.5	20.03	122	125	152	43	70	4	59	
12.5 A.M.	6400	220	-7	2000		28.2	20.03	120	125	152	43	70	4	59	
2.15 P.M.	6400	325	-76	2500	28.2	28.2	20.59	124	160	150	43	72.5	5	62	
2.45 P.M.	6450	345	-76	2950	28.2	28.3	20.59	125	157	157	43	72.5	5	62	
3.0 P.M.	6500	280	-74	2330	28.2	28.4	20.6	122	160	153	43	65.5	4	62	
3.30 P.M.	6500	230	-7	1812	28.5	28.5	20.6	120	150	154	43	65.5	2	53	

OFFICIAL TEST DATA OF "MIRRELES-LEBLANC" MULTIJECTOR AIR PUMP.

so far by the French Westinghouse Co. are within 5 mm. of the barometer. From the foregoing remarks it would appear that this type of air-pump is ideal for use on board ship, and particularly in the navy, where space is so valuable and weight of such consideration. To illustrate this point, Fig. 12 has been produced, and represents to the same scale an Edwards' air pump, Leblanc rotary air pump, and Leblanc multijector for a steam duty on a surface condenser of 40,000 lbs. per hour, with water at 60 degs. The vacuum 28½ inches, and barometer 30 inches. The weights are approximately 20,832 lbs., 4,480 lbs., and 97 lbs. respectively. For land work it is equally suitable, and will soon supersede the rotary pump in many power stations. For sugar refineries, chemical, and other allied works it should prove exceptionally attractive, and take the place of many reciprocating dry air-

out here that this pump is purely a dry air-pump, so that for surface condensers as additional water or condensate extraction pump is still required, and for jet plants, the usual extraction pump.

Fig. 13 shows the aid-dealing capacity of various sizes of multijector pumps taken from the actual tests. The maximum vacuum in each case is equivalent to the theoretical, the slight difference at the origin of the curves being due to the different conditions under which each pump was tested.

The Table of Tests is taken from a plant installed at the Scottish Central Power Station at Bonnybridge at a date six months after the plant was put on commercial load. This Company have just decided to order another plant, and have specified Mirreles-Leblanc multijector air-pumps.

Fig. 14 shows the time taken to start up a Hick-Brequet ejector and

POWER PLANT OPERATION AND MANAGEMENT

To obtain the greatest efficiency possible in a power plant is not only a matter of design, but a good deal a matter of proper operation and management. Most power plants could make large savings in this way, and there are exceptionally few where some improvements could not be made without spending a dollar for new equipment. To obtain full benefit from the equipment on hand, the men operating it must be made more efficient, and this can be done by education, strict supervision, pay according to merits (bonus system), competition and advancement, welfare.

Education, while the most important, is also the most neglected factor in economic operation of a power plant. This is especially true in the boiler room where the waste is greatest. Skilled labor should be employed. Ordinarily, anyone is hired who will work for low wages and maintain the steam pressure. Every boiler room should have a man with authority to give orders and with sufficient personality to have his orders respected. This man should predetermine by the proper use of various instruments, the most economical ways of burning coal and instruct the firemen as to the best methods, and then insist that these methods be observed.

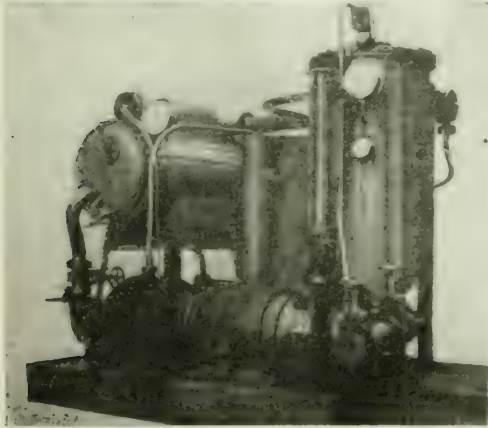


FIG. 15. APPLICATION OF "LEBLANC" EJECTORS FOR REFRIGERATING PURPOSES.

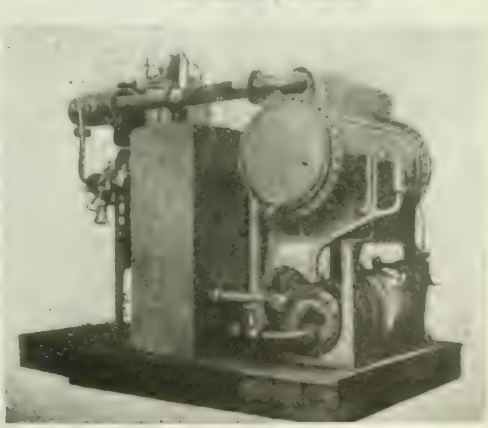


FIG. 16. APPLICATION OF "LEBLANC" EJECTORS FOR REFRIGERATING PURPOSES.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Machine, Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

UNIVERSAL GEAR HOBBER.

THE latest product from the works of the Bilton Machine Tool Co., Bridgeport, Conn., is a Universal Gear Hobber. This machine completes their line of equipment designed for cutting gears of fine pitches and of every type except internal gears. The Bilton gear miller and gear hobber have capacity for small gears up to 10 in. diameter, and, are designed to cut teeth as coarse as 8 pitch. The rated capacity of the No. 10 gear hobber is gears of 10 in. outside diameter, 10 diametrical pitch, 10 in. width of face. It will be noticed from the illustration that the frame design is proportioned and reinforced to insure rigidity and to absorb any vibrations.

The work table is driven by bronze worm gear, 11½ in. diameter. This gear in turn is driven by a steel worm, automatically lubricated and fitted with ball

thrust bearing. The hole in work table is 1½ in. diameter, so that teeth can be hobbled in end of a shaft 1½ in. diameter by 24 inches long. The table has three slots. It is also fitted with deep oil grooves having drain running to base of machine, where there is an oil reservoir. This reservoir is removable so that it can be cleaned out. The feeding mechanism consists of two shafts in vertical and horizontal position driven by means of bevel and helical gears. The horizontal feed shaft has micrometer dial. Automatic stops are fitted to vertical and horizontal feeds. All driving gears are made of steel.

The differential gears, which are shown in cut, and the feed and index gears, which are on rear end of machine, all have teeth of 14 pitch, thus making them interchangeable and allowing the fewest number of gears to be used. The vertical slide is made extra long, having flat ways with large bearing surfaces. The slide carries the hob spindle head which can be set at any desired angle for right and left hand spiral.

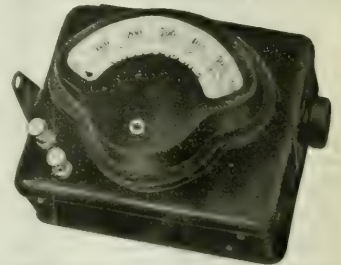
The hob spindle is bored to take a No. 9 B. & S. taper, and is carbonized, hardened and ground. It is driven by helical gears 8-10 pitch, 1 5-16 in. wide. This hob spindle can be adjusted lengthwise to relocate the hob after it has become dull in one place without disturbing the

adjustment of the spindle bearings. The hob speeds range from 50 to 250 r.p.m. The range of hob feed to each revolution of work is .010 to .125. The machine is driven by three-step cone pulley, having 2½ in. belt. The net weight of machine is 1,100 lbs.



OPTICAL PYROMETER FOR WORKS USE

FOR the measurement of temperatures above say 1400° F., only two methods have been found practicable for works

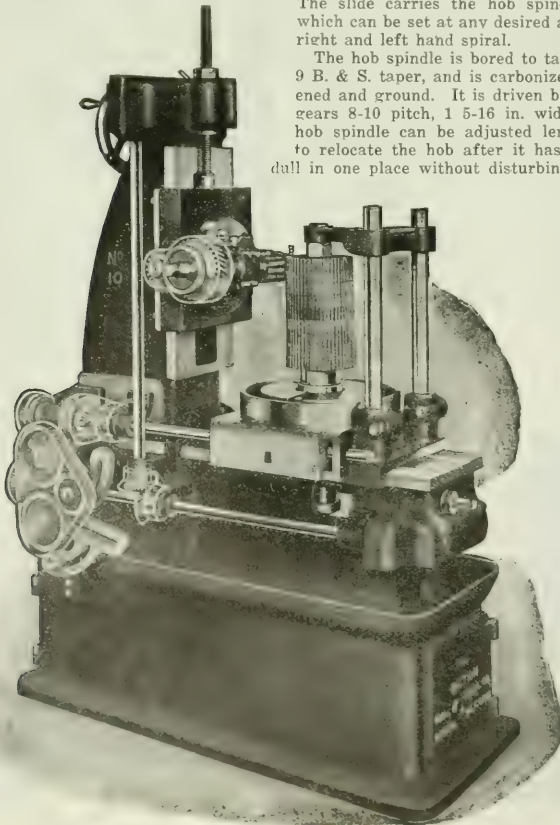


CASE CONTAINING BATTERY. RHEOSTAT AND MILLIAMMETER FOR USE WITH OPTICAL PYROMETER.

service. One of these is based on the thermocouple, used either with the millivoltmeter or with the more accurate and reliable potentiometer. The other method is based on the laws of radiation and includes both the radiation pyrometer, which would be more properly named the "total radiation" pyrometer, and the optical pyrometer, which utilizes only that radiant energy visible to the human eye.

For many services the inexpensive and sturdy base-metal couple may be used for accurate measurements up to 2000° F., with entire satisfaction; the more fragile and expensive platinum couple may be used up to 2800° F., but, the thermocouple, like thermometers in general, must assume the temperature of the hot object by convection, conduction, radiation, or all combined. This fact militates against its use for measuring the temperature of molten brass, iron and other metals, or for measuring temperatures in gas producers and other locations where the thermocouple would be subjected to rough mechanical treatment or to contamination by vapors and gases, which would rapidly impair its accuracy. In many industries the temperatures used are far above the range of thermocouples.

Measurements by radiation can be carried out at a distance, once the laws connecting temperature of radiating body and intensity of radiation have been determined, and the radiation receiving and measuring part need not be heated to the temperature of the radi-



UNIVERSAL GEAR HOBBER.

ating body, nor even anywhere near to that temperature. Pyrometers utilizing radiation are divided into two classes, those which measure as heat energy the total radiation falling upon the receiving part of the instrument, and those, known as optical pyrometers, which are based upon the fact that the luminous radiation or light varies in a definite manner as the temperature of the hot body changes.

The greatest success has been attained by separating out one kind or wave length of radiation, usually that which excites the sensation of red, and comparing the intensity of this one-color light with the intensity of the light of the same color emitted by a standard source of light. The eye is very sensitive when comparing the brightness of two surfaces when one is superposed upon the other, and after having arranged to have light from the hot body and light from the standard of comparison viewed in this relation, they can be made equal, either by varying the amount of light received from the incandescent object, or by varying the intensity of the standard of comparison.

The latter method, that is, variation of the intensity of the standard of comparison, is preferred and used by the U.S. Bureau of Standards, also by the Reichsanstalt, of Berlin, where its practical application has been brought to a high degree of perfection by Messrs. Holborn and Kurlbaum. The Leeds & Northrup Co., Philadelphia, working under the fundamental Morse patents, has lately carried on a prolonged investigation and development of this type of optical pyrometer with a view to realizing a high degree of accuracy and reliability in a simple and portable device. The instrument, which is illustrated herewith, is suitable for measuring from dull red (about 1100° F.) up to the highest known temperature.

The manner in which the luminous radiation from the hot body is balanced against that from a standardized source will be understood by reference to the accompanying figure. L is a lens by

which the observer views the incandescent filament which appears to lie upon the image, just as the cross hairs in a surveyor's telescope appear upon the distant object looked at. By means of a rheostat in a case slung about the neck,



OPTICAL PYROMETER IN USE.

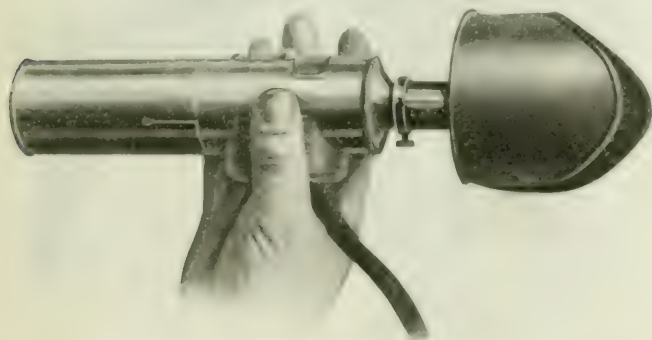
the case also containing a storage battery and a milliammeter, the current through which the lamp is adjusted until the brightness of the filament is just equal to the brightness of the image produced by the lens, that is, so that the filament blends with, or becomes indistinguishable upon, the background formed by the hot object. The observer then notes the reading of the milliammeter, which may be provided either with a special scale to read in degrees of temperature, or the temperature corresponding to the current may be read from a calibration curve supplied with the instrument. The adjustment is made with great accuracy and certainty, as the effect of radiation upon the eyes varies some 20 times faster than does the temperature at 1300° F., and some 14 times faster at 3400° F., while as above stated, the eye is very keen in distinguishing differences in brightness between superposed objects.

reason a red glass is placed in the eye piece at R, which has the further advantage that light of only one color then reaches the eye and no difficulty is introduced by lack of color identity between the light emitted by the hot body and that emitted by the filament. The intensity of light radiation of any one color increases progressively in a definite manner as the temperature of the radiating body rises, and nothing is therefore lost by eliminating all other light from the comparison. As only brightness, not color, of light is matched, inability to distinguish colors and color-blindness do not interfere with the use of the instrument. In fact, in the region of temperatures used for hardening steel, for example, different observers using this instrument agree in their readings within 6° F.

The brightness of the image of the hot body produced by the lens L is almost absolutely constant, irrespective of the distance from the hot body, although the size of the image varies with the distance. Since it is the brightness of the image and not the total radiation received through the lens that is measured, it is possible to measure the temperature of a small body or of a body at a distance equally as well as that of a large body or of one near at hand. It is not at all necessary that the hot body should fill the entire field of view of the instrument, as with total radiation pyrometers.

In observing bodies at very high temperatures, as 2500° to $10,000^{\circ}$ F., the light received through the lens would be too blinding for direct observation, even through the red glass of the eye piece, and the intensity of the image might also become greater than that at which it is practicable to burn the tungsten filament, so that a balance would become impossible. Some method for reducing the intensity of the light from the hot body, such as by varying the aperture through which the light is received or by placing a screen to intercept some of the light, is therefore necessary. A screen is used, placed between the lens and the image so that it reduces the light from the hot body, but not that from the filament. With the reducing screen it is possible to make direct observations of the most brilliant light sources, as the electric arc or the surface of the sun.

It is not feasible to calibrate the instrument at such high temperatures by direct comparison, since they are above all known melting points and the ranges of contact thermometers, but fortunately a relation has been found to exist between temperature and intensity of radiation of any one color or wave length of light. By making use of this relation, known as Wien's Law, and reducing the intensity of the image in a known ratio by means of the screen just referred to, it is possible to extend the scale of the instrument to the highest temperature. The scale thus obtained has been found to agree very closely with a scale of temperature established



THE PYROMETER IN OPERATOR'S HAND

which rays from the hot body at C are brought to a focus in the plane F, where there is located a tungsten lamp filament. By means of the eye piece E, the

At high temperatures the light emitted by both the hot body and the filament would become dazzling, and comparison would be difficult. For this

by known facts about the relation between temperature and total radiation. In other words, this form of optical pyrometer gives the same scale of temperature as do total energy pyrometers used with the precautions necessary to secure accuracy and precision in the measurement of total radiation.

The screen used for cutting off part

"black body" conditions is smaller than with the total radiation pyrometer.

The instrument can be calibrated by sighting it upon bodies whose temperatures are known, either by means of a thermocouple pyrometer, or by the melting or freezing of various substances. The constancy or reliability depends upon the constancy of the lamp, that is,

an opera glass. The case, containing the battery, rheostat and milliammeter, is designed to be slung about the neck, and weighs about 10 lb.

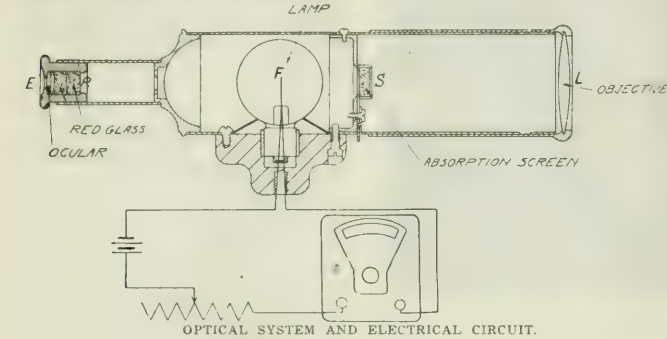
18-IN. ENGINE LATHE, WITH SHELL EQUIPMENT

THE engine lathe shown in the accompanying engraving is a standard 18-in. engine lathe with special equipment for machining 6-in. shells, consisting of 9-in. universal chuck, square European tool block, and radius forming attachment. In the lower part of the illustration is shown a plan view of the carriage with work in place and the cam roller in position at the beginning of the cam groove which forms the profile.

The cam block is held stationary by an adjusting rod carried in an anchor bracket clamped on the back vee. It is supported by a slide formed on the back of the carriage and imparts the required movement to the tool block by means of a cam roller mounted in a bow, which is fastened to the tool block. Both longitudinal and lateral adjustment of the path traversed by the cutting tool are easily obtained.

Actual tests have shown the ability of this lathe to machine a 6-in. shell to the exact radius in 16 min. 48 sec., the depth of cut being $\frac{1}{2}$ in., with 1-32-in. feed, at 130 rev. per min. The shell was composed of 50-point carbon steel, having 12 radius, and was cut at the rate of 204 ft. per min., decreasing to 69 ft. per min. at the end of the radius.

This lathe is the product of the Cincinnati Lathe and Tool Co., Cincinnati, and is regularly furnished with cabinet leg under headstock, double wall apron, automatic stop, chasing dial, 3 or 4-step cone, and any length of bed complete ready for use.

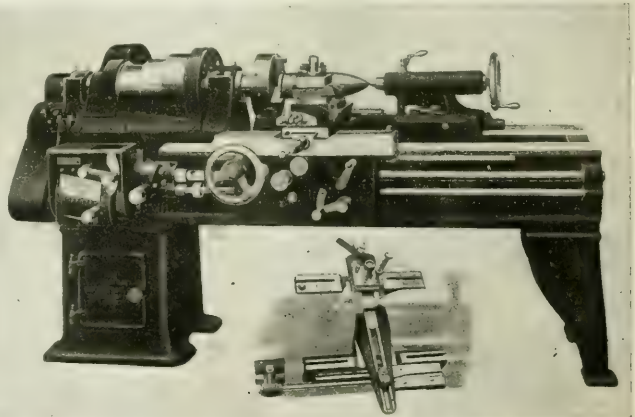


of the radiation from very hot bodies can be thrown into or out of the field of view by means of a milled disk projecting through an opening in the tube of the instrument. With the absorbing screen in use, a different millimeter scale or calibration curve is required, but as the range of the instrument without the absorbing screen overlaps many hundred degrees with the range for the absorbing screen, the accuracy of the two scales can always be checked by observing a hot body whose temperature lies within this range.

The readings obtained with this instrument are always the same for the same temperature, if the body viewed is surrounded by other objects, such as the walls of a furnace at the same temperature. Also no correction is required in the case of so-called "black bodies," such as incandescent carbon, when viewed in the open. For iron and steel in the solid state, the corrections required for readings taken in the open are also negligible.

Objects having a metallic sheen, that is, a surface which reflects light freely, as molten metal or polished platinum, do not give the same readings when viewed in the open as when viewed in the furnace, or as a black body would give with this or any other radiation or optical pyrometer. The readings, however, are always consistent for the same material under the same conditions, and by using suitable reduction factors, can be converted to true temperatures. Furthermore, the readings obtained with this type of instrument when sighted upon a body in the open differ less from those given for the same body at the same temperature enclosed in a furnace, or for a black body at the same temperature, than do the readings of instruments which measure the total radiated energy. In other words, the correction where there is a departure from

its ability always to shine with the same intensity when receiving the same current. This matter has been investigated exhaustively by the U.S. Bureau of Standards and by the Nela Park Laboratory of the National Electric Light Association, also in the laboratory of the Leeds & Northrup Co., and it has been found that after a tungsten filament is thoroughly aged, that is, burned for some time at a temperature higher than that to which it will be subjected in service, no sensible variation thereafter occurs. The instrument is so designed that one lamp can quickly be replaced by another, and by keeping two lamps, their correctness can always be



18-IN. ENGINE LATHE WITH SHELL EQUIPMENT.

insured by checking one against the other.

The instrument itself is handy and portable, weighting only about a few ounces, and can be sighted as easily as

URANIUM HIGH SPEED STEEL TESTS

CONSIDERABLE interest has been manifested in recent developments of high speed steel containing uranium as

the controlling element, and additional tests carried out by the makers amplify still further the high expectations entertained with regard to this product. Illustration Fig. 1 shows a uranium high-speed steel tool, 1 in. by 2 in., turning a 4.5-in. shell forging of heat treated steel at a speed of 70 ft. per min. The depth of cut is $\frac{1}{4}$ in., with a feed of 7-32 in. per rev. The chip produced at this rate of operation can be barely bent with the hands.

An idea of the "hogability" of this steel will be gained from the following table:

Tool	Feed	Speed ft. per min.	Depth of cut	Material Cut Before Grinding.
U.S.	1 16"	45	$\frac{1}{4}$ to $\frac{3}{4}$ "	Ran 87". Most of time the nose of tool was on scale.
U.S.	1 16" to 1 10"	38	15 16"	Ran 127". Time 3 hrs. Speed increased to 65 ft. per min. after tool had gone 105".
U.S.	1 16"	60	1 1 16"	Ran 127".

A blooming mill was turned as a further test. This material is 1.00 per cent. carbon steel with a diameter of 30 in. Using uranium high speed steel, this work was done at a cutting speed of about 18 ft. per min., the depth of cut being in excess of one inch with a feed of 13-64 in. per rev. Fig. 2 shows samples of chips from this job, the handful illustrated weighing about 2 lbs.

The comparative ability of uranium high speed steel at high cutting speeds will be understood from the following table, the distances referred to being across the face of the pinions, parallel with their axis. The best run obtained with other high speed steel was quarter of a pinion faced with one grinding, equal to a distance of $1\frac{1}{4}$ in.

CUTTING 50 CARBON PINION BLANKS 5" FACE.				
Tool	Feed	Speed ft. per min.	Depth of cut	Remarks.
U	1 32	94 6	$\frac{1}{4}$ 16	Faced 80 pinions with 5 grindings.
U	1 32	100	$\frac{1}{4}$	Faced 30 pinions or a distance of $16\frac{1}{4}$ " at one grinding.
U	1 32	100	$\frac{1}{4}$	Faced 50 pinions or a distance of $27\frac{1}{2}$ " at one grinding.

Screenings

Tony, the office janitor had been working faithfully at his job for several years, when he surprised his employer one day by asking for a vacation.

"We can't get along very well without you," said the boss. "You don't need a vacation. You'll only blow in your money and come back broke."

"I like to have vacation," persisted Tony. "I get married, and I kinda like to be there."

Two young Irishmen in a Canadian regiment were going into the trenches for the first time, and their captain promised them five shillings each for every German they killed.

Pat lay down to rest while Mick performed the duty of watching. Pat had not lain long, when he was awakened by Mick shouting:

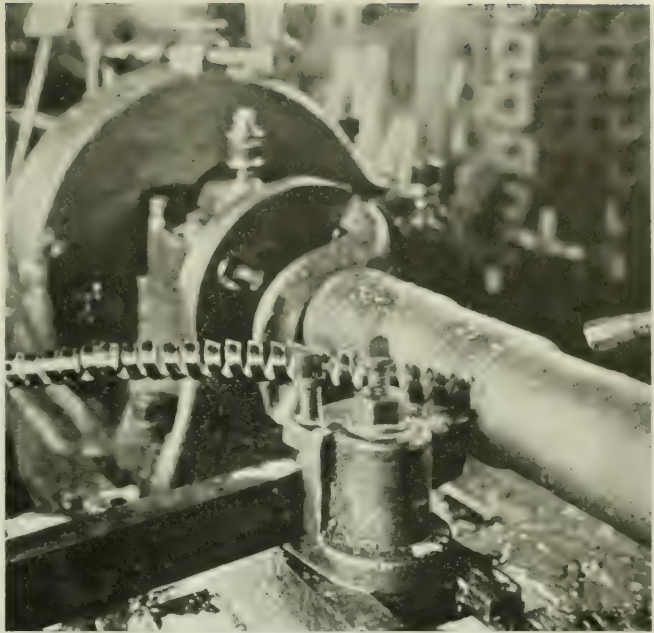


FIG. 1. MACHINING 4.5 IN. SHELL FORGING AT 70 FT. PER MIN. CUT, $\frac{1}{4}$ IN. X 7-32 IN. FEED.

"They're comin'! They're comin'!"
"Who's comin'?" shouts Pat.
"The Germans," replied Mick.
"How many are there?"
"About fifty thousand."
"Begorra," shouts Pat jumping up and grabbing his rifle, "our fortune's made."

Mother—"Johnny, you said you'd been to Sunday school this afternoon. Now I want to know how it happens that your hands smell so very strongly of fish?"

Johnny—"I carried home the Sunday-school paper, an' the outside page is all about Jonah and the whale."



FIG. 2. A HANDFUL OF CHIPS WEIGHING 2 LBS. REMOVED FROM ROLL IN FIG. 1.

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THE PROJECT TO DEVELOP CANADIAN TRADE

IN view of the interest being taken by the business and investing public in the matter of trade after the war, considerable attention has been attracted by the recommendation of the special committee of the Senate on conservation of Canadian trade that there be established in Canada a Canadian Trade Corporation. The idea, a draft of which appeared in our July 26 issue, page 93, follows along the lines of the organization which has been formed in England known as the British Trade Corporation, being the outgrowth of the proposal for the establishment of a British trade bank. According to the report of the Senate Committee, the aim is to secure orders for overseas trade, to replace in part the great volume of orders that during the war have been received for munitions and supplies, and to finance the undertaking of large overseas contracts along the lines of the British organization.

From information available, we find the future outlook very much clouded with regard to trade matters. It is difficult to forecast what conditions may be and, therefore, very hard to organize to meet possibilities. There can be no doubt but that such an organization as proposed might be an important factor in relation to the country's trade in securing information as to foreign markets. This would require a wide service employing practical men and would mean the expenditure of considerable sums in order to give it that effectiveness in securing actual orders which has been lacking in connection with the past service of our Trade and Commerce Department. To provide the necessary funds, a Government subsidy would be almost necessary.

So far as the conditions in England and Canada are concerned, it may be pointed out that there is considerable difference as to the need for such an organization. England is now out to compete more closely with Germany. She is, therefore, adopting some of Germany's methods. In England, up to the present time the banks have been practically nothing more than trust organizations, lending money on good security, but not financing new business with attendant risks. On the other hand, Germany built up her foreign trade through her banking system which was used for the encouragement of industrial expansion. Now England proposes to take a step in the same direction.

In Canada the banking system has been considered as being something between the English and German standards. Facilities have been provided for financing foreign trade through exchange and other arrangements for settlement of accounts, but the banks have not themselves taken the actual risks of manufacture.

The project, as it has been launched in the Senate, is evidently an effort to combine the trading and banking ideas so as not only to provide a market, but to aid in supplying the products to meet it. The possibilities presented are both important and interesting and the matter will no doubt receive considerable attention by the business and industrial community. Speaking with regard to the project, Senator Nichols, president of the Canadian General Electric Co., recently said in the Senate:

Great Britain has already taken action, Japan has taken action, and no doubt honorable gentlemen have all read in the despatches what Australia is doing. The Australian Government is now considering the expenditure of \$50,000,000 to assist private capital, thus recognizing the pressing necessity of aiding individual enterprise. I am not one of those who believe that the Government should take any large measures of responsibility, but it can do a great deal. We are now employing 300,000 work-people directly on munitions, and possibly 200,000 more in the production of other war supplies. When the war is over we shall have to provide these men with new employment, and we shall also have to take care of four, five or six hundred thousand returned soldiers. I think I have made that clear. No concerted action has yet been taken, so far as I can see, in an endeavor to grapple with these problems; and I feel that if concerted action is taken there is no better place for the genesis of the movement than in the Upper House of the Parliament of Canada.

During the present week, the committee report comes up in the House for adoption, and doubtless both the essentials to the success of the project and the extent of the support likely to be accorded it will become manifest.



U.S. SHIPBUILDING DEADLOCK ENDED

THE advantage of having a competent national chief executive officer received striking exemplification a few days ago when the feud between Denman and Goethals ceased to exist as a public inconvenience, or near-national scandal, so far as the United States shipbuilding programme is concerned. It has been aptly said that President Wilson is a psychologist, and being such has made him an astute politician. He is believed to be better versed in the psychology of business than would naturally be expected, in view of his training and experience and, in not a few recent instances of the exercise of his prerogative, the estimate of his capacity along the direction indicated has been fully justified. When every endeavor has been made to reconcile conflicting interests, be these individual or corporate, without closing the breach, nothing but the most drastic action remains to be taken—firing, and the community or nation executively equipped for performing the job is luckily situated these strenuous days.



"Britain need only sell Canada to us in order to pay her war expenses and also the war indemnity due to Germany and her Allies." This astonishing suggestion was made in all seriousness recently by Prince Frederick zu Lowenstein in an address on "Germany's economic future and the German peace" in Munich. How does Canada feel about it?

INDUSTRIAL NOTABILITIES

WILLIAM CLARK HAWKINS, M.E., managing director, Dominion Power & Transmission Co., Ltd., Hamilton, Ont., was born at Orange, N.J., Sept. 5, 1866, son of John Thomas and Harriet Olivia (Clark) Hawkins.

He received his education at Grammar and High Schools, Taunton, Mass., and his technical education at the Stevens Institute of Technology, Hoboken, N.J.

His career began with a position as machinist with the Campbell Printing & Press Mfg. Co., 1899, becoming draughtsman in 1890; assistant chief engineer, Third Avenue Cable Road, New York City, 1891; manager, Plymouth Electric Light Co., Plymouth,



WILLIAM CLARK HAWKINS, M.E.

Mass., 1892; manager, Concord Land & Water Power Co., Concord, N.H., 1894-96; with Columbia Water Power Co., Columbia, S.C., 1896-98; with Local Companies Committee, Schenectady, N.Y., as traveling, inspecting, and consulting engineer, 1898-1901.

Mr. Hawkins became associated with his present company in 1901, as secretary and manager of the Hamilton Electric & Cataract Power Co., later the Hamilton Cataract Power, Light & Traction Co., finally Dominion Power & Transmission Co., Ltd., being appointed managing director, Sept. 30, 1912. He is also a director of the Southern Canada Power Co.

On Dec. 28, 1898, Mr. Hawkins married Mary Elizabeth Chambers, daughter of Frank Ross Chambers, Bronxville, N.Y., their family consisting of one son and one daughter.

Clubs: Hamilton; Caledon Mountain Trout; Hamilton Racquet; Canadian; Tamahaac.

Societies: A.S.M.E.; A.I.E.E.; Beta Theta Phi; Theta Nu Epsilon.

Recreations: Angling; Tennis; Racquets.

Photo Courtesy British and Colonial Press

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey forge, Pittsburgh.....	\$47 95
Lake Superior, charcoal, Chicago.....	58 00
Standard low phos., Philadelphia.....	57 00
Bessemer, Pittsburgh.....	55 95
Basic, Valley furnace.....	33 00
Montreal Toronto	
Hamilton.....	
Victoria.....	

FINISHED IRON AND STEEL.

Per lb. to Large Buyers. Cents	
Iron bars, base, Toronto.....	5 25
Steel bars, base, Toronto.....	5 50
Steel bars, 2 in. to 4 in. base.....	6 00
Steel bars, 4 in. and larger base.....	7 00
Iron bars, base, Montreal.....	5 50
Steel bars, base, Montreal.....	5 50
Reinforcing bars, base.....	5 25
Steel hoops.....	7 50
Refined iron.....	5 50
Norway iron.....	11 00
Tire steel.....	5 50
Spring steel.....	7 00
Band steel, No. 10 gauge.....	5 75
Chequered floor plate, 3-16 in.....	12 10
Chequered floor plate, 1/4 in.....	12 00
Staybolt iron.....	8 50
Bessemer rails, heavy, at mill.....	38 00
Steel bars, Pittsburgh.....	4 50
Tank plates, Pittsburgh.....	9 00
Structural shapes, Pittsburgh.....	4 50
Steel hoops, Pittsburgh.....	5 25
F.O.B. Toronto Warehouse.....	5 50
Small shapes.....	5 75
F.O.B. Chicago Warehouse.....	5 00
Structural shapes.....	5 00
Plates.....	8 50

FREIGHT RATES.

Pittsburgh to Following Points	
Per 100 lbs.	
C.L. L.C.L.	
Montreal.....	23 1
St. John, N.B.....	31 5
Halifax.....	45 5
Toronto.....	18 9
Guelph.....	19 9
London.....	18 9
Windsor.....	18 9
Winnipeg.....	64 9

METALS.

Montreal Toronto	
Lake copper.....	\$34 00 \$35 00
Electro copper.....	34 00 35 00
Castings, copper.....	33 00 34 00
Tin.....	62 00 63 00
Spelter.....	11 00 11 00
Lead.....	13 50 13 00
Antimony.....	20 00 20 00
Aluminum.....	65 00 64 00

PRICES per 100 lbs.

PlATES.	
Montreal Toronto	
Plates, 1/4 to 1/2.....	\$12 00 \$12 00
Heads.....	12 80 12 30
Tank plates, 3-16 in. 12 65	12 25

WROUGHT PIPE.

Effective July 5, 1917.

Black Galvanized	
Standard Butt weld.	
Per 100 feet	
1 1/2 in.....	\$ 5 00 \$ 6 50
1 3/4 in.....	5 12 7 16
2 in.....	6 46 8 08
2 1/2 in.....	8 17 10 20
3 in.....	12 07 15 22
3 1/2 in.....	16 33 20 59
4 in.....	19 53 24 61
4 1/2 in.....	26 27 35 12
5 in.....	32 12 42 94
5 1/2 in.....	39 08 50 08
6 in.....	69 92 86 94
8 in.....	82 84 103 00

Standard Lap weld.

2 in.....	29 23 35 71
2 1/2 in.....	43 88 54 11
3 in.....	57 38 70 76
3 1/2 in.....	71 76 89 70
4 in.....	85 02 106 28
4 1/2 in.....	96 52 121 29
5 in.....	112 50 141 34
6 in.....	145 90 183 36
7 in.....	190 40 238 00
8 L in.....	200 00 250 00
8 in.....	230 40 288 00
9 in.....	276 00 345 00
10 L in.....	256 00 320 00
10 in.....	329 60 412 00

Prices—Ontario, Quebec and Maritime Provinces.

WROUGHT NIPPLES.

4" and under, 45%.	
4 1/2" and larger, 40%.	
4" and under, running thread.	25%
Standard couplings, 4" and under.	35%
4 1/2" and larger, 15%.	

OLD MATERIAL.

Dealers' Buying Prices.

Montreal Toronto	
Copper, light.....	\$23 00 \$22 00
Copper, crucible.....	27 00 27 00
Copper, heavy.....	26 00 26 00
Copper wire.....	26 00 26 50
No. 1 machine com- position.....	20 00 22 00
New brass turnings.....	16 00 19 00
No. 1 brass turnings.....	14 00 16 00
Light brass.....	10 50 10 50
Medium brass.....	16 00 16 00
Heavy brass.....	18 00 18 00
Heavy melting steel.....	22 00 17 00
Steel turnings.....	11 00 8 00
Shell turnings.....	12 00 12 00
Boiler plate.....	18 00 10 50
Axles, wrought iron.....	25 00 24 00
Rails.....	21 00 18 00
No. 1 machine cast iron.....	28 00 25 00
Malleable scrap.....	20 00 20 00
Pipe, wrought.....	19 00 9 00
Car wheels, iron.....	27 00 25 00
Steel axles.....	30 00 30 00
Mach. shop turn'gs.....	8 50 8 50
Cast borings.....	12 00 8 50
Stove plate.....	19 00 19 00
Scrap zinc.....	9 00 9 50
Heavy lead.....	11 00 10 75
Tea lead.....	7 00 7 00
Aluminum.....	35 00 35 00

BOLTS, NUTS AND SCREWS.

Per Cent.	
Carriage bolts, 3/4" and less.....	10
Carriage bolts 7-16 and up.....	25
Coach and lag screws.....	25
Stove bolts.....	55
Plate washers.....	List plus 10
Machine bolts, 7-16 and over.....	net
Machine bolts, 3/4" and less.....	net
Blank bolts.....	net
Bolt ends.....	net
Elevator bolts.....	50 and 5
Machine screws, 1/2 and 1/4.....	27 1/2
Machine screws, 3/8 and 1/2.....	10
Machine screws, 5/8 and 3/4.....	add 20
Machine screws, 1 and 1 1/4.....	add 25
Nuts, square blank.....	add 1 50
Nuts, square, tapped.....	add 1 75
Nuts, hex. blank.....	add 1 75
Nuts, hex. tapped.....	add 2 00
Copper rivets and burrs.....	20
Burrs only list plus.....	50
Iron rivets and burrs.....	17 1/2
Boiler rivets, base 1/4 in. and larger.....	\$7 10
Structural rivets, as above.....	7 00
Wood screws, flat, bright.....	72 1/2

Wood screws, O. & R.,

bright.....	.67 1/2
Wood screws, flat, brass.....	.37 1/2
Wood screws, O. & R., brass.....	.32 1/2
Wood screws, flat, bronze.....	.27 1/2
Wood screws, O. & R., bronze.....	.25

MILLED PRODUCTS.

Per cent	
Set screws.....	35
Sq. & Hex. Head Cap Screws.....	30
Rd. & Fil Head Cap Screws.....	10
Flat 3/8 But. Hd. Cap Screws.....	10
Fin. & Semi-fin. nuts up to 1 in.....	25
Fin. and semi-fin. nuts, over 1 in. up to 1 1/4 in.....	30
Fin. and semi-fin. nuts, over 1 1/4 in. up to 2 in.....	20
Studs.....	20
Taper pins.....	40
Coupling bolts, plus.....	10
Planer head bolts, without fillet, list plus.....	10
Planer head bolts, with fillet, list plus 10 and.....	10
Planer head bolt nuts, same as finished nuts.....	net
Planer bolt washers.....	net
Hollow set screws.....	list plus 30
Collar screws.....	list plus 30
Thumb screws.....	65
Thumb nuts.....	65
Patch bolts.....	add 40
Cold pressed nuts to 1 1/4 in.....	add \$4.50
Cold pressed nuts over 1 1/4 in.....	add \$7.00

BILLETS.

Per gross ton	
Bessemer billets.....	\$100 00
Open-hearth billets.....	100 00
O.H. sheet bars.....	105 00
Forging billets.....	125 00
Wire rods.....	95 00
F.o.b. Pittsburgh.	

NAILS AND SPIKES.

Wire nails.....	5 50 5 45
Cut nails.....	5 70 5 80
Miscellaneous wire nails.....	60%
Spikes, 3/4 in. and larger.....	6 50
Spikes, 1/4 and 5-16 in.....	7 00

MISCELLANEOUS.

Solder, strictly.....	0 38
Solder, guaranteed.....	0 41
Babbitt metals.....	16 to 65
Soldering coppers, lb.....	0 53
Lead wool, per lb.....	0 15
Putty, 100-lb. drum.....	4 35
White lead, pure, cwt.....	19 00
Red dry lead, 100-lb. kegs.....	15 45
per cwt.....	15 45
Glue English.....	0 38
Tarred slaters' paper, roll.....	0 03
Gasoline, per gal, bulk.....	0 31 1/2
Benzine, per gal, bulk.....	0 30 1/2
Pure turpentine, single.....	0 60
linsed oil, raw, single.....	1 27
linsed oil, boiled, single.....	1 30
Plaster of Paris, per bbl.....	2 50
Sandpaper, B. & A.....	list plus 20
Emery Cloth.....	list plus 33 1-3
Borax, crystal.....	15
Salt Soda.....	0 03 1/2
Sulphur, rolls.....	0 05
Sulphur, commercial.....	0 04 1/2
Rosin "D", per lb.....	0 03
Rosin "G", per lb.....	0 03 1/2
Borax crystal and granular.....	0 15
Wood alcohol, per gallon.....	2 15
Whiting, plain, per 100 lbs.....	2 20

ROPE AND PACKINGS.

Plumbers' oakum, per lb.....	.09
Packing, square braided.....	.34
Packing, No. 1 Italian.....	.40
Packing, No. 2 Italian.....	.32
Pure Manila rope.....	.37
British Manila rope.....	.31
New Zealand Hemp.....	.31
Transmission rope, Manila.....	.43
Drilling cables, Manila.....	.39
Cotton rope, 1/4 in. and up.....	.47

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto.....	25%
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CARBON DRILLS AND REAMERS.

Per Cent.	
S.S. drills, wire sizes up to 52 40	
S.S. drills, wire sizes, No. 53 to 80.....	25
Standard drills to 1 1/4 in.....	15
Standard drills, over 1 1/4 in.....	15
3-fluted drills, plus.....	10
Jobbers' and letter sizes.....	40
Bit stock.....	40
Ratchet drills.....	15
S.S. drills for wood.....	40
Wood boring brace drills.....	25
Electricians' bits.....	30
Sockets.....	40
Sleeves.....	40
Taper pin reamers.....	20
Drills and countersinks.....	list plus 30
Bridge reamers.....	45
Centre reamers.....	10
Chuckers reamers.....	10
Hand reamers.....	15

COLD ROLLED SHAFING.

At mill.....	list plus 40%
At warehouse.....	list plus 50%
Discounts off new list, Warehouse price at Montreal and Toronto.....	

IRON PIPE FITTINGS.

Canadian malleable, A, add 7 1/2%; B and C, 10%; cast iron, 35%; standard bushings, 50%; headers, 60; flanged unions, 40; malleable bushings, 50; nipples, 55; malleable lipped unions, 50.	
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SHEETS.

Montreal Toronto	
Sheets, black, No. 28 \$11 00	\$11 00
Sheets, black, No. 10 11 50	11 50
Canada plates, dull.....	
52 sheets.....	11 00 11 00
Canada plates, all bright.....	12 50 12 50
Apollo brand, 10% oz galvanized.....	12 25 12 09
Queen's Head, 28 R.....	
W.G.....	11 75 10 75
Fleur-de-Lis, 28 B.W.....	
G.....	11 75 10 75
Corbal's Best, No. 28 12 00	10 25
Colborne Crown, No. 28.....	
28.....	11 25 10 00
Premier, No. 28 U.S. 13 75	11 70
Premier, 10% oz.....	13 85 12 00
Zinc sheets.....	20 00 20 00

PROOF COIL CHAIN.

B	
1/4 in.....	\$12 00
5-16 in.....	11 50
3/8 in.....	11 15
7-16 in.....	10 90
1/2 in.....	10 70
9-16 in.....	10 70
5/8 in.....	10 50
3/4 in.....	10 40
7/8 in.....	10 25
1 in.....	10 10
Extra for B.B. Chain.....	1 20
Extra for B.B.B. Chain.....	1 80

ELECTRIC WELD COIL CHAIN B.B.

1/4 in.	\$16 50
3/8 in.	11 70
1/2 in.	8 40
5/8 in.	7 40
3/4 in.	6 35
7/8 in.	6 35
1 in.	6 35
1 1/8 in.	6 35
1 1/4 in.	6 35

Prices per 100 lbs.

FILES AND RASPS.

	Per Cent.
Great Western, American ..	50
Kearney & Foot, Arcade ..	50
J. Barton Smith, Easles ..	50
McClintock, Globe ..	50
Whitman & Barnes ..	50
Black Diamond ..	40
Delta Files ..	37 1/2
Nicholson ..	40
Globe ..	50
Vulcan ..	50
Dixson ..	50

COAL AND CORE.

Solvay Foundry Coke ..	\$10 90
Conneville Foundry Coke ..	8 50
Steam Lump Coal ..	8 05
Best Lump ..	8 05

Net ton f.o.b. Toronto

BOILER TUBES.

Size.	Seamless	Lap-welded
1 in.	\$33 00	
1 1/4 in.	35 00	
1 1/2 in.	38 00	32 00
1 3/4 in.	38 00	32 00
2 in.	45 00	33 00
2 1/4 in.	48 00	35 00
2 1/2 in.	50 00	38 00
3 in.	58 00	45 00
3 1/4 in.	60 00	53 00
3 1/2 in.	70 00	55 00
4 in.	82 00	67 00

Prices per 100 feet, Montreal and Toronto.

OILS AND COMPOUNDS.

Castor oil, per lb.	40
Royalite, per gal., bulk ..	16
Palatine ..	19
Machine oil, per gal.	26 1/2

Black oil, per gal.	13 1/2
Cylinder oil, Capital ..	43 1/2
Cylinder oil, Acme ..	38 1/2
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	2 50
Linum thread cutting oil, antiseptic ..	88
Acme cutting oil, antiseptic ..	37 1/2
Imperial quenching oil ..	30 1/2
Petroleum fuel oil ..	11

BELTING—NO. 1 OAK**TANNED.**

Extra heavy, single and double ..	30-50%
standard ..	40%
Cut leather lacing, No. 1 ..	1 50
Leather in sides ..	1 35

TAPES.

Chesterman Metallic, 50 ft.	\$2 00
Lufkin Metallic, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

WASTE.**White Cents per lb.**

XXX Extra ..	20
Peerless ..	20
Grand ..	19
Superior ..	19
N. L. C. R. ..	18
Atlas ..	18
N. Empire ..	18
Ideal ..	17
N. press ..	16

COLORED.

Iron ..	14 1/2
Standard ..	13
No. 1 ..	13
Popular ..	13 1/2
Keen ..	10 1/2

WOOL PACKING.

Arrow ..	25
Yale ..	20
Anvil ..	15
Anchor ..	11

WASHED WIPERS.

Select White ..	12
Mixed colored ..	10
Dark colored ..	00

This list subject to trade discount for quantity.

RUBBER BELTING.

Standard ..	40%
Best grades ..	20%

ANODES.

Nickel ..	50 to 51
Cobalt ..	1.75 to 2.00
Copper ..	.44 to .46
Tin ..	.49 to .50
Zinc ..	.23 to .25

Prices Per Lb.

COPPER PRODUCTS.

Montreal Toronto

Bars, 1/2 to 2 in.	55 00	53 00
Copper wire, list plus 10.		
Pin sheets, 14 oz.	40	20
14x25 in., 14x60 in.	55 00	53 50
Copper sheet, tinned, 14x60, 14 oz.	60 00	54 25
Copper sheet, planished, 14x60 base.	64 00	60 00
Braziers', in sheets, 6x1 base ..	55 00	52 00

BRASS.

Brass rods, base 1/2 in to 1 in rd.	0 50
Brass sheets, 8 in. wide, 20 oz.	0 60
Brass tubing, seamless, 1/2 in.	0 57
Copper tubing, seamless, 1/2 in.	0 58

PLATING SUPPLIES.

Polishing wheels, felt ..	3 00
Polishing wheels, bullseye ..	1 75
Emery in kegs, American ..	06
Pumice, ground ..	05
Emery glue ..	15 to 20
Tripoli composition ..	04 to 06
Crucis composition ..	07 to 08
Emery composition ..	08 to 09

Range, silver ..	55 to 56
Range, powder ..	50 to 55

LEAD SHEETS.

	Montreal Toronto
Sheet, 3 lbs. sq. ft.	\$18 00 \$18 00
Sheet, 3 1/2 lbs. sq. ft.	18 00 18 00
Sheet, 4 to 6 lbs. sq. ft.	17 50 17 50
Cut sheets, 1/2 per lb. extra ..	
Cut sheets to size, 1/2 per lb. extra ..	

PLATING CHEMICALS.

Acid, benzoic ..	\$ 15
Acid, hydrochloric ..	05
Acid, hydrofluoric ..	14 1/2
Acid, nitric ..	10
Acid, sulphuric ..	06
Ammonia, aqua ..	12
Ammonium carbonate ..	15
Ammonium chloride ..	11
Ammonium hydrosulphuret ..	40
Ammonium sulphate ..	02
Arsenic, white ..	32
Copper, carbonate, anhyd.	35
Copper, sulphate ..	17
Cobalt sulphate ..	70
Iron perchloride ..	20
Lead acetate ..	16
Nickel ammonium sulphate ..	12
Nickel carbonate ..	35
Nickel sulphate ..	15
Potassium carbonate ..	75
Potassium sulphide (sub-sulfide) ..	20
Silver chloride (per oz.) ..	65
Silver nitrate (per oz.) ..	65
Sodium bisulphite ..	10
Sodium carbonate crystals ..	05
Sodium cyanide, 127-130% ..	04
Sodium hydrate ..	11
Sodium hypophosphite, per 100 lbs.	5 00
Sodium phosphate ..	14
Tin chloride ..	60
Zinc chloride ..	60
Zinc sulphate ..	09

Prices Per Lb. Unless Otherwise Stated.

The General Market Condition and Tendency

THE steel and metal markets are marking time pending developments in the price fixing situation at Washington. Until some announcement is made in this connection by the American Government it is not likely that there will be much activity. Consumers, hoping for a general decline in prices, are holding off and consequently business is quieter. The question of the moment is, will steel prices decline, remain stationary or will a buying movement set in and cause a resumption of the upward movement, recently halted on account of the uncertain outlook? Consumers have heretofore adopted a conservative attitude and are waiting developments. Whatever may develop in regard to prices there is little doubt but that the scarcity of steel will become more acute as war requirements are bound to increase, thus diminishing available supplies for the private consumers. This will be a serious handicap, particularly for the manufacturer, whose plant operations will in consequence be curtailed and production correspondingly decreased. The situation is affecting the pig-iron market in a like manner, as it is not yet known to what extent Government control, if any, will affect furnace operations. The local pig-iron situation is unchanged and no prices are obtainable. The non-ferrous metal markets continue dull, and demand is light owing to the uncertain outlook. Consumers are keeping out of the market in anticipation of lower prices following Government action in fixing prices. The copper market is a little firmer, but quotations are unchanged. The scrap metal market continues dull and featureless, but prices are firmer. The increased activity in the machine tool industry in the States is affecting the local trade on account of the backward deliveries and high prices.

Montreal, Que., July 30, 1917.—Industrial activity proceeds unabated, although the hot weather of the past week has slowed up production. Manufacturers are still in difficulties over the inability of obtaining sufficient supplies for their requirements, and little encouragement is afforded by early prospects. The situation in the States and the approach of conscription in this country, together with the possibility of a general election in the near future, promises to place a further handicap upon present activities. Realizing the magnitude of the task before them, the American Government continues to increase the appropriations for the various needs of the many war departments, and this is having the effect of placing additional pressure on the various sources of supply, with the inevitable result that domestic enterprise is virtually at a standstill.

Pig Iron

At the close of a quiet week the pig iron situation is practically unchanged, the market being influenced by the general uncertainty that tends to disturb a relatively strong market. In common with other industries, that of pig iron is affected by existing conditions, and the position of this metal is dependent upon the attitude of the United States in the matter of fixing prices for war and kindred requirements. The local situation is unchanged, dealers reporting a

steady market, but guarded buying on the part of consumers. Canadian iron is still off the market.

Steel

A combination of circumstances have resulted in a quiet and listless market; the uncertainty that has pervaded the situation for several weeks is still pronounced, and buyers are more reluctant to enter the market owing to its unsettled conditions. The extreme hot weather has materially affected production, and the general tendency appears to be in direct contrast to the nervous disposition to secure material a short time ago, irrespective of the price asked by the producers. The feature of the present situation seems to be the waiting attitude of the consumers in regard to the action of the American Government in relation to the fixing of prices on war requirements. The impression seems to be spreading that the "one price to all" will not be strictly enforced, and it is expected that this policy will only apply to such contracts that are made exclusively for Government or war purposes. During this temporary lull, producers and dealers are endeavoring to dispose of their surplus supply of stock on hand. A feature that is creating some little concern in the United States situation is the increased appropriations being made by the Government for the various war necessities, tending to still further disturb the general market. The absence of any marked activity is reflected in the quiet condition of the iron and steel market, the general situation having taken on a strain of listlessness. With the market at present in a presumably strong position, the early future is dependent on the decision of the U. S. Government in connection with the finding of the commissions now inquiring into the present cost of production of steel and metals. The outstanding feature in respect to existing conditions is the impetus that has been given to the shipbuilding activities and the increased demands placed upon the plate mills for requirements in this connection, and it is now anticipated that the pressure on the mills will be much greater than previously expected. The enormous demands for tin plate for food and sundry requirements have necessitated considerable tonnage of sheets being reserved for this purpose. Quotations on all commodities indicate the uncertainty that prevails in all circles. Local conditions are unchanged, as the situation here is more or less affected by the existing conditions across the line. Dealers here report an exceptionally quiet week, with all quotations firm and unchanged.

Metals

Despite the uncertainty that is still marked in all circles, the general tendency this week seems to have improved, although price quotations are still about the same. Copper is returning to a stronger position after a period of weakness. Tin is not active, but has a stronger tone. Spelter is quiet, but with a better undertone. Lead is again gaining strength. Both antimony and aluminum are quiet, with the latter easier.

Copper.—Following the contention some few weeks ago, that the price of copper would be adjusted to a lower figure than that prevailing on the open market, the buying movement on the part of consumers fell off considerably, with a corresponding decline in listed quotations; however, during the past few days an evident reluctance to dispose of their metal has been evident on the part of producers and holders of metal, and in what sales have been made, the price shows another upward tendency. This condition has not, however, given much stimulus to the market, as the trade is still holding aloof awaiting the final decision of the American Government regarding price regulations. The London market is £5 lower than last week, but the New York report shows a slightly stronger position, lake having advanced 1c and electro 1½c per lb, the respective quotations being 30c and 28½c. Prices on the local market are firm and unchanged; lake and electro at 34c, and castings at 33c per lb.

Tin.—Despite the fact that consumers are not actively interested in the market

CANADIAN GOVERNMENT PURCHASING COMMISSION

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion \$100,000,000 war appropriation:—George F. Galt, Winnipeg; Hormidas Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the Commission headquarters are at Ottawa.

the tin situation is developing a stronger tone, which has been reflected in both London and New York prices. Spot tin is rather scarce owing to difficulty in obtaining shipping permits from England. The delayed action of the American Government is still a restraining feature of the market. The London market is about £4 higher and New York quotations of 62½c show an advance of ¾c per lb. Local tin is firm at 62c, but with a stronger undertone.

Spelter.—With the prospect that price regulations may result in a better position for spelter, owing to the margin between the existing price and the cost of production, the buying of this metal has improved during the past week, but so far no marked strength has been added to the market. New York continues to quote the nominal price of 8½c per lb. Dealers here report a firm, but quiet market, with quotations unchanged at 11c per lb.

Lead.—The downward tendency that was so apparent last week has evidently been stopped, and lead is again returning to a stronger position, as reflected in the higher quotations on the New York market. The feeling that large quantities of lead will be required for the war programme of the American Govern-

ment has had the effect of stiffening the market. An apparent reluctance on the part of producers and dealers to dispose of any but small quantities of metal has resulted in the outside quotation again advancing to the same level as that quoted by the Trust—namely, 11c per lb. The local situation is steady, with prices firm at 13½c per lb.

Antimony.—The market is quiet and featureless, with the supply exceeding the demand, although a slight undertone of strength seems apparent. New York continues to quote the nominal price of 15c on a light demand. Local conditions are unchanged at last week's price of 20c per lb.

Aluminum.—The market in this metal has developed a weaker tendency following a decrease in the demand, and consequently prices have become easier. Dealers here are quoting 65c on a quiet market, a decline on the week of 5c per lb.

Machine Tools and Supplies

The machine tool requirements are now covering a more general line of equipment owing to the increased activity in the shipbuilding and other industries. Demand for munition machinery is very quiet at present, especially here in Canada, owing to the capacity production of those plants now working on shells. There has been, however, a marked increase in the inquiries for general engineering tools as a result of the impetus in the manufacture of marine accessories. The situation in the States is featured by the possibility that the Government may commandeer all available equipment suitable for their immediate requirements. In the case of tools now under construction for private interests, it may be required that these are to be used for Government work, or have them revert to plants working on war contracts.

The pressure that is being placed on the machine tool builders in the States is making it increasingly difficult for Canadian manufacturers to obtain delivery on ordered equipment, and these conditions may call for additional activity on the part of tool builders here to meet the steady Canadian demand. The continued advance in the cost of raw materials is being shown in the higher prices that are asked for tool equipment; this condition also applies to all classes of supplies.

Scrap

While the general situation is comparatively quiet, due to pending political developments in the States, the market has become a little stronger and in many cases prices have advanced. Old coppers have advanced 2c per lb, the price range being 23c for light and 26c for heavy. Heavy melting steel and steel turnings have advanced \$2, quotations being \$22 and \$11 per ton respectively. Old boiler plate on a \$3 advance is quoted at \$18 per ton. Rails at \$21, machine cast iron at \$28, and wrought iron pipe at \$19, show an advance of \$2 per ton each. Cast borings are now quoted at \$12 per ton.

Toronto, Ont., July 31.—The outlook for the manufacturing interests is steadily becoming more confused in spite of the large volume of business offering. The shortage of raw materials, particularly iron and steel, is becoming more acute, while the labor situation is also becoming a menacing problem to handle owing to the difficulty in obtaining sufficient help. There appears to be no doubt that the coal situation is serious, and the uneasiness among those interested in securing large supplies of fuel is increasing. Drastic measures will have to be adopted if factories are to be kept in operation this coming winter. Much valuable time has already been lost in dealing with the situation, and much remains to be done before the desired relief is effected.

Steel

The situation in the steel trade at the present time is one of doubt and uncertainty; many consumers consequently are staying out of the market pending developments. There is now considerable difference of opinion as to the extent and probable effect of the American Government price fixing scheme. There is a growing belief that the Government actions will not be so drastic as was at one time considered probable. It is felt that while steel prices for Government needs will likely be fixed on some equitable basis, it will be a more difficult matter to control the situation as affecting private consumers. It is also doubtful whether such action on the part of the Government is either feasible or desirable. Until this question is settled, little activity may be looked for in the market. For the same reason there has been a lull in the upward movement in prices, and here again opinions differ as to the probable effect on the situation by Government action. Some believe that the crest has been reached, while others declare that the law of supply and demand will prevail, and consequently prices will continue to advance. What will actually happen is exceedingly difficult to foretell, and the prevailing policy of watchful waiting seems to be the correct one.

There is no change in the situation in the primary market as regards black sheets. The American Government buying of sheets is increasingly heavy, which is restricting available supplies for other consumers. The output of sheets of all grades is pretty well sold up for the remainder of the year. No prices on sheets have as yet been fixed by the American Government, although it is paying considerably under the market for current requirements. The steel market in the United States is quiet, pending developments in the price situation. The new demand for steel products of all kinds is light, as consumers are holding off until it is known what the Government will do in the matter of prices. There have been no price changes this week.

Pig Iron

The pig iron market is less active than formerly on account of the uncertainty as to what the Government attitude is

with respect to prices. For this reason buying has fallen off considerably until the situation clears. There is no change in the Canadian situation and prices are still withdrawn.

Scrap

The scrap market continues dull and unsettled, with a lack of interest on the part of consumers. Prices on scrap with the exception of heavy melting steel and machinery cast iron, are weak and unchanged.

Machine Tools

The situation in the machine tool trade locally is practically unchanged, the general run of business being principally for equipment for general engineering purposes. In the United States, Government business is the most important feature, and is occupying the atten-

MARKET LETTER DEVELOPMENT

The attention of metal working plant executives is directed to the enlargement of the scope and usefulness of our Market Letter Department. In New York and Pittsburgh, expert correspondents have been engaged, and are already furnishing each week concise reports of production activities, price movements, etc., within the territory served by each of these important centres. During the next few weeks, further additions will be made to the number of our United States correspondents, embracing other industrial centres, and enlarging thereby the scope of the meantime service being rendered.

tion of the trade almost exclusively. Deliveries are not any better, except on ordinary lathes, which are fairly easy to obtain. Large swing lathes, however, are difficult to get. Grinders, milling machines, both plain and universal screw machines, boring mills and planers are scarce. Prices of all types of machine tools are very firm, with an upward tendency owing to the continued high cost of raw materials.

Supplies

Prices of practically all lines of machine shop supplies continue to advance steadily owing to the high cost of raw materials, while deliveries are not showing any improvement. It is anticipated that there will be some restriction in the consumption of gasoline, as a serious shortage is feared. Although prices are unchanged in the meantime, it is likely that there may be an advance.

Metals

The metal markets continue dull and weak, but prices are unchanged meantime. Trading has again been light, as consumers are keeping out of the market in view of possible lower prices following Government price regulation. Locally business continues good, principally because of war orders, but the ordinary demand is also active.

Copper.—The market has a stronger undertone, but prices continue nominal and unchanged. There has not been a great deal of actual business, but more interest has been shown, which may result in a buying movement in the near future. Lake and electrolytic are quoted at 36c and castings at 35c per pound.

Tin.—The market is quiet but firmer, and quotations continue nominal. There is a scarcity of spot tin in New York caused by an unwillingness to grant shipping permits in England. Government price regulation continues to restrain the market. Local price, 63c per pound.

Spelter.—The American Government has recently purchased a considerable quantity of spelter at 11c and 11½c, according to grade, which represents an advance of 2c over the previous purchase. The price indicates that the Government authorities agree with the producers that the present production cost of spelter has been too close to the selling price. Following this transaction, the spelter situation has improved and the market is firmer. Local quotation unchanged at 11c per pound.

Lead.—The market continues strong and quotations are firmer. There is not enough lead in sight to satisfy current demand, especially for immediate or nearby delivery, and independents are now quoting the same price as the Trust, viz., 11c New York. The local situation is unchanged at 13c per pound.

Antimony.—The market has a weak tendency at unchanged and nominal prices. Local price, 20c per pound.

Aluminum.—The market continues quiet and lack of buying support has weakened it. Local price, 64c per pound.

New York, July 30.—Machinery manufacturers and machine tool builders in the United States are flourishing as never before. It is estimated that contracts secured in July call for the payment to the builders of approximately \$10,000,000 and inquiries are now in the market aggregating as much more. As heretofore, the greatest demand comes from shipbuilders who have closed or are about to close large Government contracts, but manufacturers of airplanes, of motor trucks, of engines and motors, and of electrical apparatus—also holding large Government contracts, or anticipating them, are feverishly in the market to satisfy pressing needs for shop equipment.

It is not surprising under present extraordinary conditions that machinery manufacturers are overwhelmed with conflicting demands for priority tool shipment, so much so, that some of the requests are being referred to the Priority Board at Washington for settlement. It is significant that when the tools purchased are found to be for private work, they are being taken to direct shipments to plants holding Government contracts, and this practice is likely to be extended widely in the next few months until Government needs, directly and indirectly, have been satisfied.

Shipbuilding Enterprise

The Federal Shipbuilding Co. is the name of the new subsidiary of the United States Steel Corporation to which reference was made several weeks ago. The initial appropriation to build this plant, including twelve shipways, is \$6,000,000, and other funds will be available as they are needed. It is expected to build ships within six months, which means that the cranes and necessary tools to be installed must be delivered in four months. The American Bridge Co., which will build the plant and furnish the fabricated steel for ships, is placing substantial orders for special machinery.

The settlement of the controversy between Chairman Denman of the Shipping Board and General Goethals, general manager of the Emergency Fleet Corporation, by the withdrawal of both officials from Government service, and the appointment of their successors by the President, has been followed by the announcement that fifteen contracts, some of them carrying ten to twenty ships, have been approved by the Shipping Board, and the execution of the contracts only awaits the confirmation of the other new members of the Board by the Senate. There is small doubt now that contracts for building two large Government shipyards, in which to build 400 steel ships, will be awarded within a week, and work will be rushed upon these vessels. The large private interests identified with this enterprise have continued to place orders for cranes and for machinery, requesting deliveries on some tools in two months.

Two other shipbuilders having Government contracts—the Kelly-Atkinson Construction Co., and the Groton Iron Works, are actively in the market for cranes and for shop equipment. The latter company, alone, will expend \$2,000,000 to equip a plant at New London, Conn.

The Navy Department is negotiating for machinery and tools to cost \$2,500,000 to equip the new shops to be built at the Washington Navy Yards for the manufacture of torpedoes, mines, mounts, telescopes, sights, optical instruments and miscellaneous ordnance supplies.

The six manufacturers who have been awarded contracts by the United States Army Department to build 10,650 motor trucks, at an aggregate cost of \$33,179,026, are already in the market for steel castings and machine tools of special design.

Many other large manufacturers, both with and without Government contracts, are in the market for several million dollars' worth of machinery. The General Electric Co. has closed for twelve cranes and is negotiating for \$1,000,000 worth of shop equipment to be used in the manufacture of turbine engines for the United States Navy. Export inquiry continues active, mainly for shipment to Italy and Japan.

Pittsburgh, Pa., July 28.—The iron and steel markets continue stagnant, and the

chief interest of the trade is with respect to the question when market prices will be so readjusted that buying can be resumed in normal volume. There is no keen interest even in that question, however. Conditions have been so tense for a long time, and business has been conducted under such high pressure, that the trade welcomes the relief, and is glad to take a breathing spell. It is vacation season, too.

The turnover in pig iron in the past week has been extremely light. There has been practically no business done in forward deliveries, and in early deliveries the transactions have been surprisingly few in number. Pig iron quotations are substantially unchanged. There has been a little reselling by consuming interests at slight cuts from furnace quotations, but not enough to make a fresh market. Some furnaces have dropped maximum quotations, but have not reduced minimum quotations. Some interesting, almost amusing, reports are going around about furnaces fixing limits beyond which they promise not to advance because they "think prices high enough." The action is quite gratuitous.

In unfinished steel, billets and sheet bars, there has been no business done in the past two or three weeks to show where the market stands. There has been some inquiry, which has elicited the same quotations as formerly from producers, and a statement from buyers that they will wait a while. Mills are calling upon contract customers to furnish heavier specifications for billets, which is probably a significant development. An observer with wide opportunities for gathering information ventures the opinion that a round lot of billets could not be sold for over \$80. The market is quotable, nominally unchanged at former prices: \$95 to \$100 for billets and \$105 to \$110 for sheet bars. As for many months past, the mills have sold billets and sheet bars for early deliveries only, except for their regular long term contracts, a definite break can easily come earlier in billets than in pig iron or finished steel products.

In finished steel there has been a minimum of business. The large mills have booked favorite customers for some additional tonnages, as old contracts became nearer worked out, but such business is done at inside prices and is not significant. In prompt deliveries little has been done, there being less demand and extremely little mill capacity available. Prices are not quotably changed, though in some quarters the market may be described as a shade easier.

Price Control

The opinion is not so strong as a fortnight ago that the Government will eventually control iron and steel prices to the general trade. It has no authority to do so, and there is no strong feeling in Congress in favor of the power being created. There is little doubt that the Administration would seek the power if prices continued to advance, or even if it seemed probable that they would not decline, but it is now established that the

market will eventually decline if left to its own devices.

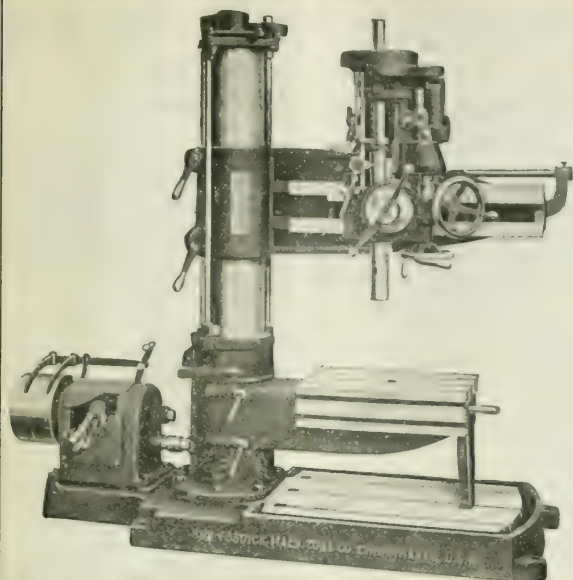
There is one direction in which the Government can exercise an influence on iron and steel prices generally, and that is in coke, provided the Food Control Bill as it is put into shape by the conference now in progress between the House and Senate carries the provisions as to coke contained in the Senate bill, as passed July 21. That bill gave the President authority to fix prices for "food, feed and fuel," the fuel including coke, petroleum and gasoline. In the case of coke, for instance, he would be empowered to take over and operate a coke works, selling the product to the public, or he could require the owner to sell to the public, or to a Government agency to be established, coke at a fixed price. To comply with constitutional requirements, the compensation fixed by the President, either for the product or the use of a plant, is made conditional, the owner of the plant having the option of accepting the price or accepting 75 per cent., and suing the United States, according to established practice, for whatever more he thinks he is entitled to.

Should the President exercise this authority with respect to coke, Connellsville furnace coke, which sold up to \$16 per net ton at ovens just before Independence Day, and is now about \$10, would probably be fixed at about \$5 and kept there, and buyers of pig iron would expect at least as large a concession. This would start the ball rolling, and a general decline in iron and steel prices would probably be precipitated.

As to prices on steel for the Government, an arrangement was made a fortnight ago between the steel committee of the American Iron and Steel Institute and representatives of the Government that the Federal Trade Commission should determine the present cost of production, prices then to be fixed to furnish a reasonable, but what the Government would call a "liberal" profit. The cost report was expected in about three weeks, but latest advices are that it will be many weeks still before it is forthcoming. It is expected in most quarters that these prices, when made public, will have a sentimental influence in pulling down the whole market, not necessarily to the Government level, but at any rate by a large amount.

Jobbers Unloading

Many jobbers are now offering freely certain descriptions of steel, evidently because they wish to enter the period of readjustment with as light stocks as possible. Their stocks are not particularly large in the aggregate, but they will stand considerable paring down. Manufacturing consumers are reported to be fairly well stocked, better than would have been supposed, considering the pressure they have been exerting on mills in the past few months for deliveries. Buyers are taking deliveries quite well, but are not urging heavier shipments, and their specifications on contracts are at a still more reduced rate, the first noticeable decrease in specifications having occurred early in June.



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We invite you to come out and look over our plant. You will be pleased with the up-to-the-minute design and many conveniences for the workmen, and the adequate equipment it contains.

Send along blue prints or samples of your work for quotations.

J. R. STONE TOOL & SUPPLY CO.

DETROIT, MICHIGAN

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INDUSTRIAL ^A_ND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News

ENGINEERING

Windsor, Ont.—The Maloney Electric Co. are erecting a \$12,000 reinforced concrete and brick factory addition.

Sherbrooke, Que.—The Canadian Ingersoll-Rand Co. will start work shortly on the construction of a new machine shop.

Halifax, N.S.—L'Air Liquide Society of Montreal will build a factory here to cost about \$20,000. Contracts have been let.

Montreal, Que.—The Magnolia Metal Co. is making arrangements for the erection of a plant estimated to cost \$60,000.

Montreal, Que.—The Mount Royal Tunnel & Terminal Co. are disposing of a large quantity of contractors' machinery and equipment.

Fort William, Ont.—The Canadian Car & Foundry Co. are finishing their plant here in preparation for the building of freight cars for the Dominion Government.

Montreal, Que.—It is reported that the Dominion Government may take over the munitions plant at Verdun. This institution is now under the control of the British authorities. The plan is that the Government should operate it until the close of the war.

Palmerston, Ont.—The Village of Moorefield, seven miles south of Palmer-

ston, voted last Friday to have Hydro electric connection with Palmerston. Only three opposed the project. Drayton, which has already carried the by-law, will be connected with Palmerston also.

Estevan, Sask.—W. J. Dick, mining engineer of the Commission of Conservation at Ottawa, announces that he understands the Government has appropriated \$250,000 for the purpose of establishing a briquetting plant at Estevan, where the lignite coal in South-eastern Saskatchewan will be treated.

Windsor, Ont.—At a cost of \$150,000, a factory will be built here for the Maxwell Motor Co., of Detroit. R. Westcott, contractor, of Windsor, has been awarded the contract. The building will be two-storey, 100 feet frontage and 300 feet deep. Automobiles for Canadian and British Empire trade will be manufactured at this factory.

Hamilton, Ont.—H. N. Cole, of Syracuse, N.Y., is visiting Hamilton. Mr. Cole explained that he is here in the interests of the Semet-Solvay Co. of Syracuse, which contemplates establishing a coke plant in this city. The company's prospective site is at the foot of Dupew Street, and Mr. Cole is here to make some detailed report of the property.

Amherstburg, Ont.—Within twelve months, if the present schedule is carried through, the big local plant of the Brunner Mond Co., Canadian branch of the Solvay Process, will be in full operation. The excavations of the big ten-story main building have already been completed, and the form work for the concrete foundations is partially in. Part of the reinforced concrete for the cellars has already been run. Excavations for the boiler-house, milk of lime house and lime kiln are in and work on two chimneys, one 250 feet high and the other 175 feet, have already been started by the Canadian Kelly Co. A waterworks system will be installed.

ELECTRICAL

Moorefield, Ont.—With the help of the Township of Maryborough, the police Village of Moorefield is moving to have Hydro-Electric light and power supplied by the Hydro Commission; \$4,500 will be the amount necessary, it is estimated. Twenty-year debentures will be issued for the amount, if the necessary by-law is carried.

Brockville, Ont.—At a joint meeting of the Town Council and Public Utilities Commission a resolution was passed authorizing the Ontario Hydro Electric Power Commission to proceed with the delivery of power to Brockville, to be furnished by the Cedar Rapids Transmission Co. at a price of \$35.95. Brockville will require a block of 1,500 horse-

power at 2,200 volts for the present. It was said that this arrangement which the Hydro Electric has made with the Cedar Rapids concern will probably be only temporary, as the commission hopes to supply Eastern Ontario with electrical energy developed at the Long Sault Rapids before many years.

GENERAL

Jonquiere, Que.—Price Bros. & Co. will build an extension to their paper mill here.

New Westminster, B.C.—The Dominion Products Co. will build an addition to their plant.

Chambly, Que.—The Canadian Leather-board Co. have let a number of contracts for their new factory.

Brantford, Ont.—The Slingsby Manufacturing Co., has secured a permit for a new house to cost \$5,000.

Brantford, Ont.—The Kitchen Overall Co., which has been occupying rented premises in the city since its organization, has secured land on George street and will shortly build a complete new factory.

London, Ont.—Penmans, Ltd., announce the opening of a new mill here.

AUXILIARY MACHINERY REQUIRED.

Tender forms and specifications have been received from D. H. Ross, Canadian Trade Commissioner, Melbourne, for supply and delivery of auxiliary machinery for the Flinders naval base, via Melbourne, Victoria, and are open for inspection at the Department of Trade and Commerce, Ottawa (refer to File No. A-1901). Tenders addressed to the Director of Navy Contracts, Navy Office, Melbourne, close on October 24, 1917. The particulars are as follows:

Two electrically-driven air pumps, with complete set spare parts.

One steam driven air pump, with complete set of spare parts.

Two small circulating pumps.

One large circulating pump.

One large feed pump, with complete set of spare parts.

One small feed pump, with complete set of spare parts.

One oil fuel pump with complete set of spare parts.

PUMPING EQUIPMENT REQUIRED

Tender forms, specifications and drawings have been received from D. H. Ross, Canadian Trade Commissioner, Melbourne, for the supply and delivery of pumping plant and equipment for the Commonwealth naval dockyard, Cockatoo Island, Sydney, N.S.W., and are open for inspection at the Department of Trade and Commerce, Ottawa (refer to File No. A-1901). Tenders addressed to either the Director of Navy Contracts, Navy Office, Melbourne, or the Director of Naval Contracts, care Commonwealth Naval Dockyard, Cockatoo Island, Sydney, N.S.W., close on October 10, 1917. The particulars are as follows:

Two main dock pumps with vertical spindle motors and control equipments.

One vertical spindle motor and control equipment.

Four sluice valves with four motors and control equipment.

Two drainage pumps with motors and equipment.

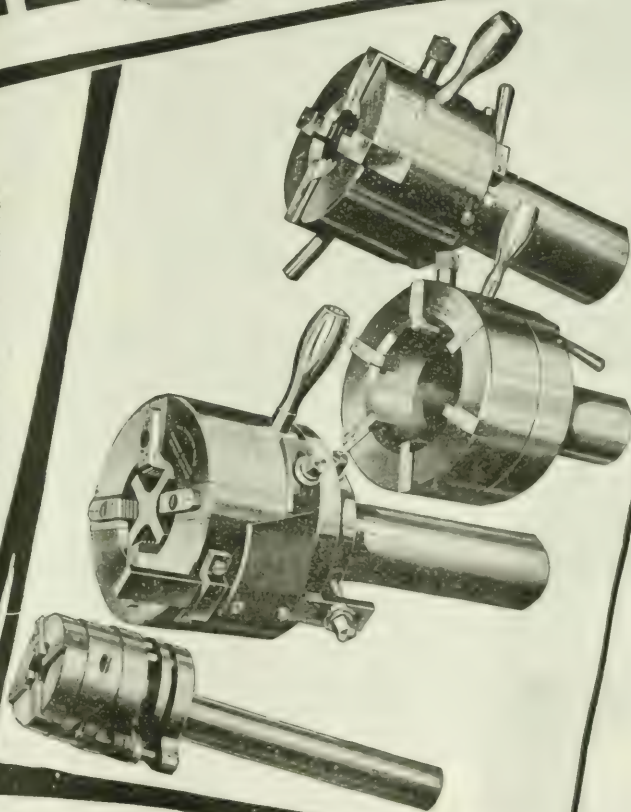
Two air exhaust pumps with motors and equipment.

One enclosed motor and equipment for dock caisson.

GEOMETRIC DIE-HEADS

HERE'S a quartet of die heads that means death to threading trouble. They are worthy representatives of the Geometric family — among which can be found a Self-Opening Die Head or Collapsing Tap for any thread you could possibly want.

These tools can be adapted to any make of turret lathe or screw machine. Many manufacturers already make them standard equipment. We are convinced that the rest will, eventually; any Geometric user will tell you why.



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Tool Room Surface Grinder

Easily Adjusted, Strong, Accurate, Fast

Has rigid grinding surface and large tray and water jet combined. It is an unbeatable tool room surface grinder. Tell us your requirements, wants, experts on special features. Satisfaction assured.

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No. 4 Press
10 to 12
tons.

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
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with some 75 employees, and it is hoped to increase this number very shortly to 175. The work in this mill consists in finishing the underwear which is made in Paris and elsewhere and also in knitting hosiery.

Winnipeg, Man.—The Reliance Investment and Developing Co., capitalized at \$500,000, are now preparing plans for the erection of a modern clay products plant which will be built adjoining their property in the north-west part of the city. It is the intention of the company to equip this plant with suitable machinery for the manufacture of high-grade burned clay products. The plans of the company call for the erection of a fireproof plant, costing approximately \$100,000. In the installation of the machinery equipment all possible arrangements will be made to produce economical operation in order to turn out these materials at a minimum cost. A. E. Hilder is the manager of the concern.

MUNICIPAL

Verdun, Que.—The City Council have passed the first reading of a by-law empowering the city to issue bonds for \$200,000 general improvements.

Winnipeg, Man.—The Board of Control are receiving bids on a quantity of road and contractors' machinery and equipment, electrical apparatus, pumps and scrap metals, etc.

Beeton, Ont.—The ratepayers will vote on August 6 on the Hydro enabling by-law and also on a by-law to raise \$15,000, which sum, it is estimated, will be necessary to put the transmission plant in good order.

London, Ont.—The ratepayers will vote on a proposal to guarantee the bonds of the Ajax Rubber Co. to the extent of \$450,000. The company agrees to build and equip with machinery and manufacturing accessories a plant to cost at least \$300,000, and to make at least 900 tires daily, also to employ at least 250 hands.

Smith's Falls, Ont.—At the special meeting of the Town Council two by-laws were introduced and will be presented to the electors. The first is to raise the sum of \$135,000 to purchase the two local electric light plants. The Smith's Falls Electric Light Co. \$75,000, and the Citizens' Electric Light Co. \$60,000. Also a by-law to take the votes of the ratepayers of the town on a question to be submitted whether the ratepayers are in favor of an agreement with the Hydro-Electric Power Commission and to appoint officials.

PERSONAL

Arthur Vincent, C.E., has been appointed town engineer of Longueuil, P.Q., in succession to the late F. Barbeau.

Mark Workman, president of the Dominion Steel Corporation, has left Montreal for Cape Breton, where he will visit the scene of the disastrous explosion which occurred at New Waterford recently.

B. F. Repton has been appointed controller of the Canadian Car & Foundry Co. and its subsidiaries, with full charge

of the accounting work in its various phases. Mr. Repton was associated with Messrs. Price, Waterhouse & Co., in New York, for over ten years, and subsequently held the position of general auditor to the Dominion Steel Corporation in Sydney, N.S., for several years. Mr. Repton has already entered upon his new duties.

Roland C. Harris, Commissioner of Works for the City of Toronto, has been appointed to act, in an honorary capacity, as Fuel Commissioner for the Province of Ontario, in association with the Federal Fuel Commissioner, C. A. McGrath. Mr. Harris will co-operate with the Federal Commissioner in all matters affecting the fuel situation within the Province of Ontario, and it is understood that his appointment will be ratified by a Dominion Order-in-Council.

James Fulton Cummings, a pioneer electrical engineer, who for many years was associated with the interests controlled by Thomas A. Edison, died on July 27, at Long Beach, N.Y. Mr. Cummings, who was born in London, Ont., 48 years ago, installed the first electric light stations in Philadelphia, Cincinnati and a number of other cities. He then went to Russia, where he worked out the plans by which electric wires in St. Petersburg, as the capital was then called, were placed in underground conduits. He did similar work in London and other English cities. He was considered one of the foremost engineers in that particular line of work.

TRADE GOSSIP

Maple Leaf Tires Co., has changed its name to that of the Mackintosh Rubber Co. of Canada, Ltd.

Toronto, Ont.—It is reported that the Thor Ironworks have been sold to the Standard Shipbuilding Co. of New York.

Quebec, Que.—It is reported that the centre span of the Quebec bridge will be put in place on the morning of September 12.

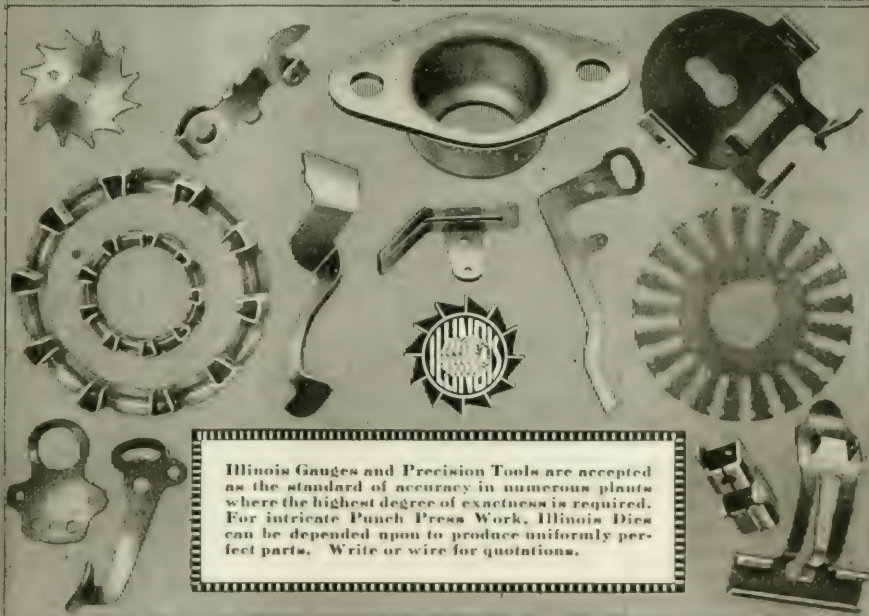
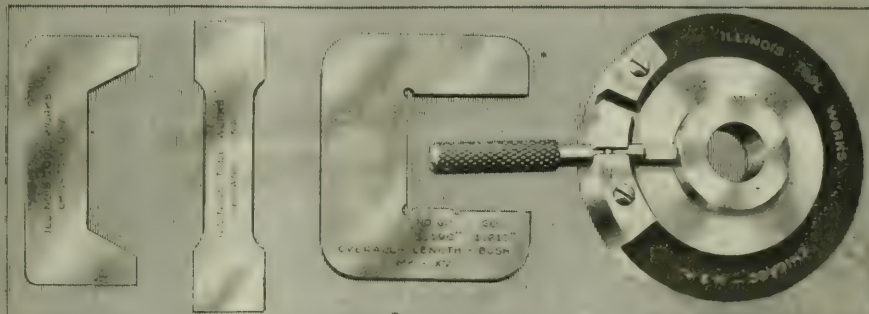
The Roelofson Elevator Works, of Galt, Ont., have been awarded a contract for elevators for A. Burritt & Co.'s knitting factory at Mitchell, Ont.

Tungsten Prices Firm.—The supply of tungsten ore is light and the market continues proportionately strong. High grade wolframite in New York has sold at \$25 for spot and scheelite at \$26. Buyers are inclined to cover requirements during the balance of this year. Producers are firm at current prices.

Big Order for Pennmans.—Pennmans, Ltd., of Paris, Ont., has received the greater part of the contract recently placed in Canada by the United States Government for 30,000 dozen of cotton underwear, and further orders are in sight. The American Government offered to contract for 50,000 at a cost of around \$1,000,000.

Bids for Natironco Wreck.—Six bids have been received by the underwriters for the purchase of the wrecked Canadian steamer Natironco, which was sunk in collision in the Lower Detroit River several weeks ago. The bids

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ranged all the way from \$25,000 to \$32,000, the latter being by A. B. Mackay, of Hamilton, former owner of the vessel, who acted for French interests.

Railway Board to Take Over Intercolonial.—A despatch from Ottawa states that the Intercolonial Railway will be placed under the jurisdiction of the Dominion Railway Board. The necessary legislation, promised some time ago, has been introduced in the Commons by Hon. Frank Cochrane. The measure is an important one, it that it will give the Railway Board full control over rates, freight and passenger traffic, etc.

Trade Inquiry.—The following inquiry has been received by the Department of Trade and Commerce: Ottawa: 1084—Machine tools, metals, chemicals, oils and foodstuffs.—A Swedish firm established in Stockholm, Sweden, and Petrograd, Russia, desires to get in touch with Canadian manufacturing concerns wishing to develop export business after the war, especially machine tools, metals, chemicals, oils and foodstuffs.—A representative of the firm is now in New York City. The address can be obtained on application to the Commercial Intelligence Branch, Department of Trade and Commerce, Ottawa.

C. P. R. Open Club House.—Every facility for outdoor recreation is offered at the new club house and grounds of the C. P. R. Recreation Club, at Sortin Junction, near Montreal, which has been opened this summer and is now being enjoyed by about 750 members. With sixty acres of grounds and the use of forty acres more, and with a modern and commodious building of forty-five rooms, employees are provided at an annual membership fee of \$1, with the attractions of a first class country club. The club was formed last fall as a social organization, but did not grow rapidly. This year some heads of departments and higher officials became interested in it and extended its scope.

May Restrict Use of Coal.—C. A. Magrath, Fuel Controller for Canada in an interview at Ottawa recently urged the people of the country to be prepared to submit to inconveniences and personally to do all in their power to conserve the coal supply. Moreover, he called upon coal dealers to unload shipments of that fuel delivered to them as rapidly as possible in order that as many cars as possible might be available to bring supplies into the country. He intimated that if the war dragged on for many months longer, he might find it necessary to place restrictions in the use of all sorts of fuel, including coal, wood, gasoline and even natural gas.

Would Welcome Lower Freight Rates.—That Canadian manufacturers would certainly appreciate a reduction of ocean freight rates which is promised by the Shipping Commission represented by the Governments of Great Britain and the United States, was the opinion expressed by William Rutherford, president of the Montreal Branch of the Canadian Manufacturers' Association recently. The question of tonnage and high rates was a matter, he said, of considerable

concern to the exporter, and the announcement that there would be a sweeping reduction in the latter would be especially acceptable in view of the fact that many goods could not be exported owing to the present prohibitive rates.

The British Corporation Registry of Glasgow, Scotland, at the instance of the Imperial Munitions Board, has established a branch in Toronto. Owing to the large number of hulls on the stocks in the various shipbuilding yards, the Imperial Munitions Board deemed it necessary that official surveyors should constantly be in touch with the work. For the past seven years Captain J. B. Foote, manager of the Marine Department of the Toronto Insurance and Vessel Agency, has had complete charge of the survey work in the matter of classing and supervising steel ships. Under the new arrangement Messrs. David Arnott and P. R. Court, naval architects and surveyors, who have arrived from Glasgow, Scotland, will be associated with Captain Foote in the work.

Ontario Water Powers Investigation.—Hon. I. B. Lucas, Attorney-General, announces that three High Court judges, Chief Justice Sir William Meredith, Justice Sutherland and Justice Kelly, had been appointed by the Ontario Government as a commission to investigate the amount of water used for power by the different electrical developing companies in the province. Under the Water Power Regulation Act passed at the last session of Parliament authority was given to the Government to name such a commission, whose duty it would be to investigate the amount of water used in the generation of power, the amount of power developed or generated, and the works or equipment installed by the various companies, in order that they might not exceed the limits to which they were entitled. The commission will begin operations within a few weeks, and will report as to the price that should be charged the companies for the excess power developed.

TENDERS

Strathroy, Ont.—Tenders are requested for direct connected motor-driven turbine pump, 80 Imperial gallons capacity, against a head of 20 feet. For full particulars, apply Public Utilities Commission, Strathroy, Ont.

Strathroy, Ont.—Tenders are requested for building concrete reservoir and pump houses. Specifications and tender forms may be obtained from Messrs. Kerry & Chace, engineers, Toronto, or Public Utilities Commission, Strathroy, Ont. Tenders received by the Commission, Strathroy, up to noon, August 8.

Ottawa, Ont.—Tenders will be received until August 27 for plumbing pipes and fixtures required in the reconstruction of the Parliament Buildings. All tenders to be based on the execution, erection and completion, including all labor and materials required for the installation of the plumbing system, together with all fixtures, apparatus and appliances as called for in the plans and specifications. Plans, specifications and

any other information can be obtained at the office of the general contractor, P. Lyall & Sons, Construction Co., Ottawa

BUILDINGS

Cordage Co. will build a warehouse at their factory on St. Patrick Street.

Toronto, Ont.—Lieut.-Col. W. S. Dinick, president of the Anglo-American Hotel Co., states that the building of the new Devonshire Hotel will be delayed owing to the difficulty in obtaining steel.

Galt, Ont.—Plans for the new hydro station are now in the hands of the Ontario Hydro Commission for its endorsement, and as soon as this is obtained tenders for the construction of the building will be called for.

Toronto, Ont.—The Royal Bank of Canada will erect a new branch office at 456 Yonge Street. The City Architect has approved of the plans for a stone and brick building estimated to cost \$22,000, and a permit has been issued accordingly.

INCORPORATIONS

The Gaylord Engineering & Construction Co., has been granted an Ontario provincial license to carry on business as a contracting and construction company. W. J. Elliott of Toronto is the Attorney.

Techno-Chemicals, Ltd., has been incorporated at Ottawa with a capital of \$49,900 to manufacture chemical products and compounds at Montreal. The incorporators are Charles Hurtubise, Gabriel Hurtubise and E. Jaquemont all of Montreal.

The British American Shipbuilding Co., has been incorporated at Ottawa by F. H. Keefer and A. L. Martin of Thorold, Ont., also A. A. Kinghorn of Toronto, to build and repair ships of all types with a capital of \$1,000,000. The head office is at Toronto.

The Richmond Mfg. Co., has been incorporated at Toronto with a capital of \$200,000 to make general munitions machinery including chucks of all descriptions, reamers, taps, cutters, etc., in Toronto. The provisional directors are W. W. McNight, N. Cowrian and E. B. McNight all of Toronto.

RAILWAYS—BRIDGES

Edmonton, Alta.—It is expected that the Peace River bridge, which is being built by the Central Canada Railway Co., will be finished this fall. The bridge will cost, when completed, about one million dollars.

Toronto, Ont.—The bridges which the C. P. R. will construct on the line between Leaside and North Toronto will be built of reinforced concrete, and will be 386 feet long. Wells & Gray have the contract for one bridge, and the Dominion Bridge Co. will build the other. J. H. Barber is chief engineer in charge of the work.

Toronto, Ont.—The C. P. R. have started in to rush construction of the small piece of new line between North Toronto and Leaside, and thereby couple

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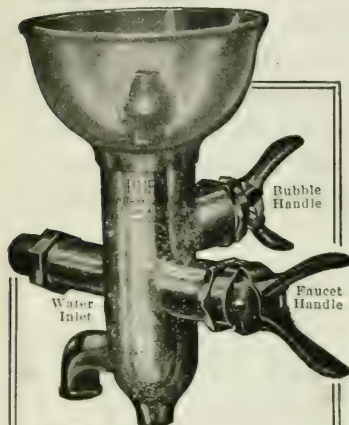
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their double track from Agincourt via North Toronto to Guelph Junction (43 miles). This little piece is just over a mile, from the east end of the North Toronto yard to the west end of the Lease-side yard; but it includes in its specifications two new and expensive bridges and a high-class subway. The first bridge will be a three-track one over Reservoir Park ravine; the second one a double-track one over the Belt Line ravine, nearer Lease-side.

WOODWORKING

Midland, Ont.—The new company which was recently incorporated with a capital stock of \$200,000 for the purpose of taking over all the property owned by Benson & Bray, Ltd., and the business which has been conducted for the last six months by Playfair & Pratt, is to be known as the Midland Wood Products, Ltd. For the present this new concern will make shell boxes, excepting that a portion of this plant will be leased to the Midland Engine Works for the purpose of making shells.

Vancouver, B.C.—Announcement that the receiver for the Canadian Pacific Lumber Co. has leased for a term of three years the four mills of the company at the foot of Salsbury drive, Port Moody, Alberni Canal and the upper Arrow Lake, was made recently by C. B. Macneill, K.C. The four mills have a united production of 80,000,000 feet of lumber yearly, and will aid materially to meet the demand for B. C. lumber, which at present is so great that orders for Eastern Canada as well as orders for abroad are being refused.

CONTRACTS

St. John's, Que.—The Laurin & Leitch Construction Co., Montreal, have the general contract for pumping and filtration plant for the Town Council.

Tecumseh, Ont.—J. R. Sculland, of Windsor, has the contract for reinforced concrete water tower and basin costing \$6,500 for the Eau Claire Waterworks Co.

MARINE

Basin, N.S.—The Chester Basin Shipbuilders, Ltd., has been incorporated and proposes to establish a shipbuilding plant at Basin.

Toronto, Ont.—A floating drydock has arrived here for the Toronto Dry Dock Co., who will operate a shipbuilding plant at Ashbridge's Bay.

Ottawa, Ont.—The House has passed votes aggregating \$338,000 for bridges and harbor works in Ontario. This includes \$96,000 for harbor improvements at Port Stanley.

Halifax, N.S.—The Tusket Shipbuilding Co. have purchased the saw mill of the Parker-Eakins Co., at Tusket Lakes, and are laying the foundation for a new mill at Milner's Lake.

Goderich, Ont.—Word has been received that an appropriation of \$55,000 has been made for the harbor work needed at Goderich in connection with the establishment of the Goderich Shipbuilding Co.'s plant here. The work in-

cludes the construction of slips for launching into and dredging.

Vancouver, B.C.—A new concern, the Vancouver Shipyards & Engine Works, contemplate establishing a shipbuilding plant here. The company is said to be capitalized at \$750,000, and has left contracts for the preliminary work which will prepare the building ways. S. Matheson is interested in the company.

Montreal, Que.—The Montreal Dry Dock Co. have practically rebuilt their plant on Mill Street. Since last year, when the dock had a capacity equal only to repairing scows and barges, extensive alterations have been made. The dock has been deepened, and machinery added to the equipment. The dock is 428 feet long and 30 feet deep.

CATALOGUES

The Greenfield Tap & Die Corporation, Greenfield, Mass., have published an interesting manual containing instructions and information issued to their employees.

Firebox Boilers.—Catalogue No. 62 issued by the Dominion Radiator Co., Toronto, illustrates and describes the Safford-Kewanee firebox boilers for steam and water heating. The catalogue also contains specifications and price lists and sectional views of boiler settings.

Anti-Fouling Compositions.—The American Venetian Paint Co., New York City, have issued a catalogue describing the "Lamoravia" anti-corrosive and anti-fouling compositions for ships bottoms. The merits of the various compositions and methods of application are dealt with while the various claims as to the durability and efficiency of these materials are also discussed at length.

"Mor-Lite" Plant.—Canadian Fairbanks Morse Co., Montreal and Toronto, have issued an attractive booklet illustrating their Mor-Lite self-starting, self-stopping and self-running electric light generating plants for private use. Complete specifications of the plant are given, and its compactness combined with convenience for country homes are the chief features.

Electric Lamps.—Bulletin No. 78 describes the Cooper Hewitt electric lamps for photographic purposes. The bulletin gives full particulars and prices of the various outfits and different apparatus used in connection, accompanied by illustrations. The bulletin also contains suggestions as to the proper outfit to be used for various purposes in photography with illustrations showing studio arrangements. Copies of the bulletin may be obtained from The Cooper Hewitt Electric Co., Hoboken, N.J.

Manufacturing Lathe.—A catalogue recently issued by the Porter-Cable Machine Co. of Syracuse, N.Y., features a manufacturing lathe specially designed for the economical production of duplicate parts in large quantities. The catalogue is arranged in two sections. The first section contains a detailed description of the principal features embodied in the design of this lathe with illustra-

tions showing these parts and attachments. The second section illustrates and describes several universal milling attachments, the principle feature of each being referred to. Boring heads and end mills are also described while the concluding page contains a partial list of users of the Porter-Cable manufacturing lathe.

BOOK REVIEW

Progress in Water Works Pumps.—Waterworks pumping plants have recently undergone a rapid and radical evolution. The tremendously heavy and expensive, although efficient, triple-expansion pumping engine has given place to the more compact, simple and less costly steam-turbine-driven centrifugal pump. The efficiency of the latter has risen steadily with the experience of its builders and with improvements in auxiliary equipment, until duties under standard steam conditions exceeding 150,000,000 ft. lb. per 1,000 lb. of steam are now obtained. The De Laval Steam Turbine Co., of Trenton, N.J., builder of the largest pumps of this type, has just issued, under the title "Progress in Water Works Pumps," a 48-page booklet discussing the general economic and engineering conditions affecting the design and installation of such pumps. Installations in 15 of the principal cities of this country and Canada are described, including 34 units aggregating 999,000,000 gals. per day capacity. The publication should be of value to any one interested in the handling of water in large quantities.

The Economical Purchase and Use of Bituminous Coal for Heating Homes.—The University of Illinois has issued a circular dealing with the economical operation of small house heating plants and the saving in coal that can be effected. The University of Illinois has discussed, in the circular referred to, the more important factors involved in the installation of a satisfactory house heating system, and has set forth the most economical methods of firing soft coal and operating a house heating plant. The properties of fuels, and the processes attending their combustion are discussed in a fashion which is intended to help the average householder to understand his problem and to secure the economics of intelligent operation. Copies of this circular may be had by addressing the Engineering Experiment Station, Urbana, Illinois. The price is ten cents.

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turret lathes, fitted with pot chucks with
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Rainbow Stair Bldg., Toronto, Ont. c5m

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Speed Engine, centre crank, 12 x 12, 280 R.P.M.
1—36" x 16" Fifield Screw Cutting Engine Lathe,
5-step cone, 4" belt, screw and rack feed, com-
pound rest, countershaft 1 3/8" x 18" Putnam
Screw Cutting Engine Lathe, screw and rack
feed, 5-step cone, 4" belt, compound rest. All
of the above are in splendid condition. Canadian
Engineering & Mfg. Co., Ltd., 128 Bleury
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squeezing water cushion and wooden outside
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WANTED AIR COMPRESSOR — MUST BE
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1 18 x 10 Rahn-Larmon Engine Lathe,
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1—18 x 12 Rahn-Larmon Engine Lathe,
new.

1 22 x 10' Nicholson & Waterman En-
gine Lathe.

1—No. 13 B. & S. Automatic Gear Cutter.

1—30" Newark Automatic Gear Cutter.

1 15 x 18 Pratt & Whitney Plain Grinder.

1 No. 2 Bath Universal Grinder.

1—12 x 60 Modern Plain Grinder, new.

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acquainted with scientific management; 25 years'
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ARE YOU LOOKING FOR PRODUCTION IN
your tool room? High-grade tool room fore-
man desires position in a fuse or shell factory
where results count. Will be at liberty Aug.
1st. Do not reply if you do not want a man to
take full charge. Box 323, Canadian
Machinery.

A PRACTICAL MACHINE SHOP SUPERIN-
tendent of broad experience in Canada and
States will be open for position as superintend-
ent or general foreman, July 15th. All refer-
ences. Address Producer, Box 321, Canadian
Machinery. c5m

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THOROUGHLY CAPABLE BRASS FOUNDRY
Foreman to take charge of small foundry do-
ing a general jobbing business and also munition
work. Location Montreal. Address for infor-
mation, "Brass Foreman," P.O. Box 1934, Mon-
treal. c26m

MECHANICAL DRAFTSMAN WANTED.
Experienced on engines or turbines, cap-
able of working out engine details. Apply
giving full particulars as to experience, salary
required, and enclose references, to Henry
Hope & Sons of Canada Limited, Peterborough,
Ont. c6m

NIGHT SUPERINTENDENT FOR SHELL MA-
chine plant in Western Canada; knowledge
of four point five shell and good all-round ex-
perience essential. Write, stating qualifications,
salary and references, otherwise application will
not be considered. Box 325, Canadian Machinery. c6m

WANTED—ASSISTANT SUPERINTENDENT
for six-inch shell factory. Must be capable
of getting maximum production from an estab-
lished plant and have good mechanical experience.
Duties to consist chiefly in supervising production.
Give full particulars in writing of previous ex-
perience, age, references, and salary required, to
Henry Hope & Sons of Canada, Ltd., Peterboro.
All information will be treated in the strictest
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TECHNICAL ADVERTISING MAN — LARGE
manufacturing concern near Toronto, building
a general line of heavy machinery, requires a
young man to take care of its advertising; must
be able to prepare machine descriptions from blue
prints and to write clear, concise English; adver-
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please state age, nationality, experience and
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with first letter. Box 320, Canadian Machinery. c26m

FOR MILL MACHINE SHOP—A COMPETENT
foreman with energy and resource, with some
knowledge of French; also general machinist for
small shop in a modern town with established
manufacture. This is an opportunity for family
man to locate to permanent benefit. William S.
Nish, 53 Maple Avenue, Slawinigan Falls, Quebec.
c3m

- American 5" Plain Radial Drill, 3" spindle, box table, h.p., tapping attachment, M.D.
Bickford 4' Plain Radial Drill, cone drive, La Pointe Broaching Machine.
Toledo No. 204 Spc. Double Crank Press
Toledo 400-lb. Board Drop Hammer.
2-P. & W. No. 2 Cutting-off Machines.
Bement Miles & Co. 7½" Spindle, Vertical Drilling and Boring Mill, 68" swing.
Gardner No. 24 Belt-driven Disc Grinder.
Bradley 150-lb. Upright Strap, 150-lb. helve, 75-lb. Upright Strap Hammers.
Detroit Japanning Ovens, 8' 10" x 8' x 8"
Gisholt 28" Turret Lathe, taper attachment, M.D.
Pratt & Whitney 48" Gap Lathe.
Hanna 30-ton Riveter.
Pangborn San Blast, 84" rotary table, M.D.
3 500-ton G.E. Hydraulic Double Action Presses.
1—Toledo Toggie Press, No. 165½.
1—Ferracute Press, Dag 66.
Bliss Presses—3 No. 60½, rack and pinion: 1 No. 77½; 1 No. 87 special geared.
3—2¼ Cleveland Automatics; prac. new.
5—3" x 36" J. & L.
Allis-Chalmers 150 H.P. Corliss Engines.
Bruce MacBeth 150 H.P. Gas Engine; new.
2—Rathmann Jones Gas Engines, 125 and 225 H.P.



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OUR GUARANTEE:
Your money back, if you return
machine within 30 days from date
of shipment, freight prepaid.

No Excuses Necessary

Some very latest models—None over 2 years old

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- 25—21" Gisholts, 3½" hole, 2-step, 5" belt.
- 25—21" Gisholts, 3½" hole, motor arrangement.
- 15—24" Gisholts, 4¼" hole, 3-step, 4" belt.
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- 42—24" Gisholts, 6" hole, motor arrangement.
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- 2—2½" x 26" Pratt & Whitney Gd. Hd. Turrets.
- 4—No. 3-A Warner & Swasey (bar machines).

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- 24—22" x 8' Hamilton, D.B.G., C.R., Semi-Q.C.G.
- 5—22" x 8' Hamilton, D.B.G., Turret tool post.
- 4—22" x 8' Davenport, D.B.G., Turret tool post.
- 7—22" x 10' Hamilton, D.B.G., C.R., Semi-Q.C.G.

- 2—22" x 10' Hamilton, D.B.G., Turret tool post, Semi-Q.C.G.
- 20—22" x 10' Davis, D.B.G., C.R., Q.C.G.
- 8—24" x 10' Lodge & Shipley, D.B.G., C.R.
- 8—24" x 10' Lodge & Shipley, Selective Gd. Hd., C.R., Q.C.G.
- 11—26" x 10' American, D.B.G., C.R., and carriage turret, Q.C.G.
- 2—26" x 10' American, D.B.G., carriage turret.
- 19—26" x 12' Putnam, carriage turret, Semi-Q.C.G.
- 9—26" x 12' Putnam, C.R., Semi-Q.C.G.
- 2—26" x 12' Wickes, D.B.G., C.R., Semi-Q.C.G.
- 10—28" x 10' Niles, Bement, Pond, D.B.G., Q.C.G.
- 4—28" x 14' Lodge & Shipley, Select. Gd. Hd., motor drive, C.R., turret and taper.
- 3—30" x 16' Lodge & Shipley, D.B.G., C.R., turret and taper.
- 11—40" x 18' Pittsburgh, triple geared, Q.C.G.

The above are a few representative machines. We also have a big list of Planers,
Vertical and Horizontal Boring Mills, Millers, Shapers, Gear Cutters, etc.

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DRILLING MACHINES

Leland H.S., H.B., bench type.
No. 1½ Knight Driller and Miller.
14" Rockford Sensitive
20" Kern, b.g.
22" W. F. & J. Barnes, s.h., b.g., p.f.
No. 25 Eoste-Burt 24" drill (new).
32" W. F. & J. Barnes, s.h., b.g., p.f.
32" Hamilton, s.h., b.g., p.f.
No. 30-C Baush, 12 spindle.
20" W. F. & J. Barnes, 1 spindle.
3" W. E. Gane Plain Radial.
Pawling & Harnischfeger Horizontal Driller.
No. 1B Bement Horizontal Driller and Borer.
48" Colburn Mill, 2 swivel heads.

GEAR CUTTERS

Reynolds Hobber.
No. 11 B. & S. automatic.
30" x 9" G. & E. auto. for spur and bevel.
24" x 7" G. & E. for spur.
No. 3-26" B. & S. for spur.
86" Walcott for spur.

GRINDERS

Yankee Drill.
Leland Universal, with power feed.
No. 23 B. & S. Gear Cutter.
8" x 30" Modern Plain (new).
14" x 20" B. & S. Plain.
Garvin hole grinder.
Gisholt tool grinder.
No. 5 Diamond water tool.
No. 16 Gardiner disc grinder.
No. 24 Gardner disc grinder.

LATHES

13" x 5' P. & W., c.r., taper.
14" x 6' Fairbanks, c.r., taper.
16" x 6' Prentice, c.r.
18" x 8' L. & S. pat. head, c.r., taper.
18" x 10' Fitchburg, c.r.
18" x 12' Barker, c.r.
20" x 14' Blaisdall, c.r.
21" x 12' New Haven, c.r.
24" x 13' New Haven, c.r.
32" x 16' Blaisdal, c.r.
36" x 20" American, L.b.g.
36" x 22" New Haven, L.b.g.
3½" x 60" Fitchburg Lo-Swing.

PLANERS

36" x 36" x 16' Sellers, one head.
36" x 36" x 12' Cleveland, open side, 3 heads
and arranged for motor drive.
36" x 36" x 12' Detrich & Harvey, open side,
2 heads, one side head.
40" x 38" x 14' Putnam, one head.
40" x 40" x 12' New Haven, one head, one
side head.
40" x 48" x 18' New Haven Planer, 2 heads,
2 extension heads.

SCREW MACHINES

1" B. & S. Plain.
16" P. & W. Plain.
No. 2 Foster, plain head.
No. 2 Costello, plain head.
No. 2 P. & W. friction head.
No. 3 Foster, geared head.

No. 1 Pearson, geared head.
No. 3 Bardons & Oliver, plain head.
No. 12½ Garvin, friction head.
¾" Cleveland, automatic.

TURRET LATHES

16" Lodge & Shipley.
25' Niles.
2 x 21" Jones & Lamson.
3 x 36" Jones & Lamson, chucking equip-
ment.
3 x 36" Jones & Lamson, bar equipment.
21" Gisholt, with taper.
2-24" Gisholt turret lathes, taper attachment.

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No. 2 L. & A. Angle Iron Shears, 5"x5"x1½"
(new).
No. 5 L. & A. Double Punch & Shear, ¾"x5½",
3"x3½", 1½" rd. (new).
No. 1 L. & A. Multiple Punch (new).
No. 2 L. & A. Multiple Punch (new).
No. 1 L. & A. Horizontal Punch, ½" in 1"
(new).

MISCELLANEOUS

No. 2 Kennamith Universal Miller.
50-lb. Bradley Strap Hammer.
100-lb. Bradley Helve Hammer.
¾" Acme Forging Machine.
52" Niles car wheel boring mill.
3" Stover Pipe Machine.
6" x 14" P. & W. Thread Miller.
No. 1 American Air Tempering Furnace.
Belt Lacing Machine.
3-ton Yale Duplex Hoist.

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Special Machinery, Jigs, Fixtures, Punches and Dies, Small Tools, Screw Machine Products, Gauges, Forgings, Etc.

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Jobbing Machine Shop Owners

will find it to their advantage to mail us a list of their equipment and state what line of work they prefer to undertake.

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METAL MANUFACTURERS SERVICE

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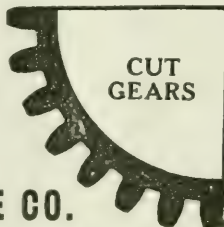
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GEAR & MACHINE CO.

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& Van Horne

TORONTO

SERVICE—REAL GEAR SERVICE
is what you want.



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Let us quote on your requirements.



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No. 28 THREAD GAUGE FOR NOSE OF SHELL

ONLY \$35.00

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THE MONARCH BRASS MFG. COMPANY, LIMITED

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WE DESIGN AND BUILD
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Rawhide — Steel — Brass — Cast
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Try our W.G. Rawhide Silent
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AUTOMATIC MACHINERY
FOR MUNITIONS

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TORONTO TOOL CO.
TORONTO, ONT.

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TO SELL or buy from Canada such lines as machinery, hardware, food products, dry

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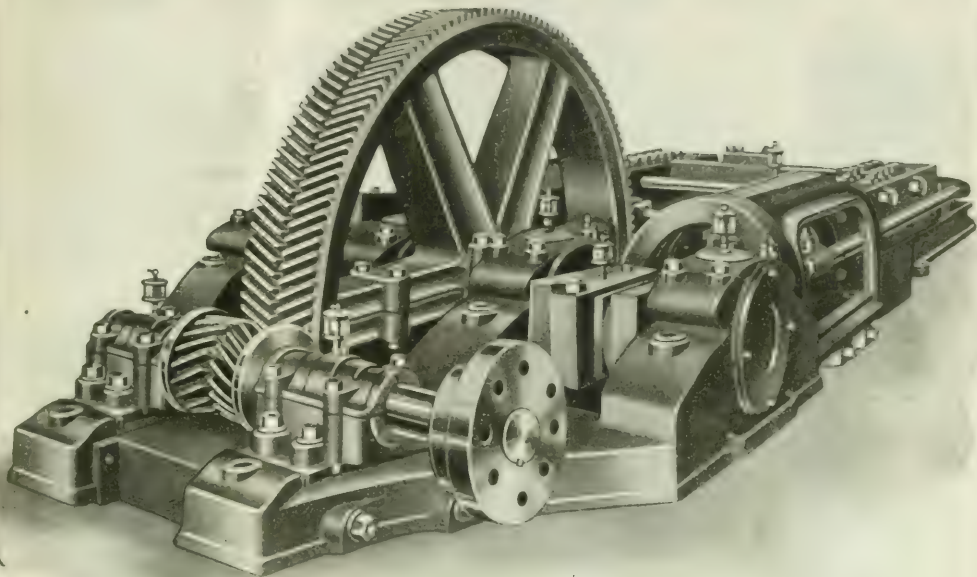
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Immediate shipment to Canada or any part of the world of pumps and motors.

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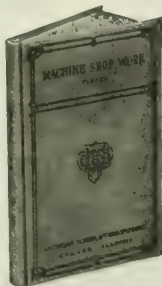
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Montreal Machinery & Supplies, Ltd., 260 St. James Street, Montreal, Canada
Representatives for the Province of Quebec.

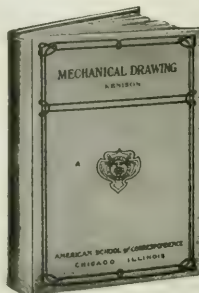
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Technical Book Department

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Starrett

TRADE MARK

REG. U. S. PAT.

Bench Micrometer

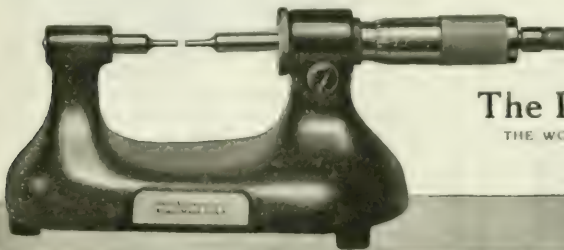


Here are facts that will interest manufacturers in their inspection work.

In the first place the Starrett Bench Micrometer Caliper, because of the lock nut, can be used as a gage to determine the accuracy of duplicate parts of any size up to an inch. You will notice, it has a heavy base and a three-point support so that it will stand firmly on any surface.

It is readily adjustable for wear, too, a most important feature. Just bring the points together, turn the graduated sleeve with the small spanner wrench until the lines marked zero coincide—and there you are. You have a gage that may be used to maintain the accuracy of parts of a thousand different sizes—and it is always accurate.

Send for free catalog No. 213 describing 2100 styles and sizes of fine tools.

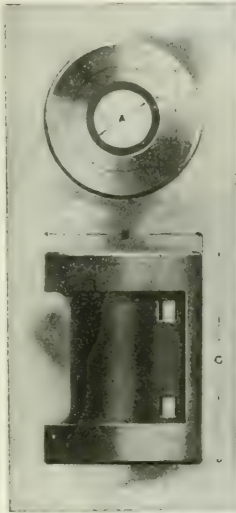


The L. S. Starrett Co.
THE WORLD'S GREATEST TOOLMAKERS
Athol, Mass.



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Two-key Tappet

**Shoes and Dies, Tappets,
Bosses, Cams and
Stamp Heads**

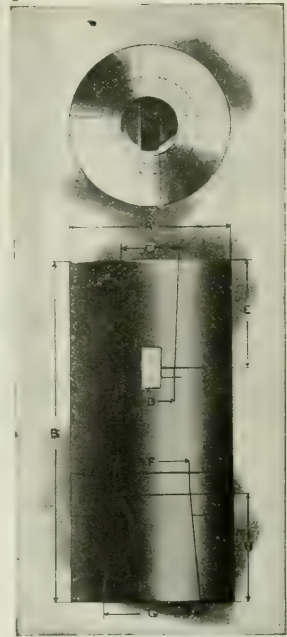
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Plates for Ball and Tube Mills
Concaves and Heads for Gyratory
Crushers.

Machine Moulded Gears

Any size up to 18 feet in diameter.
No patterns needed.

*Send Us Your Specifications,
We Do the Rest. Write—*

Hull Iron & Steel Foundries, Limited
HULL, P.Q.



Stamp Head



WHITING AIR HOISTS

Most convenient for the many
quick, short lifts about the
average shop.

Valve stem does not pass through
air chambers and therefore no
packings are required.

Automatic cutoff guards against
waste of air.

All details the result of many
years' study in manufacturing and
operating cranes and hoists of all
kinds.

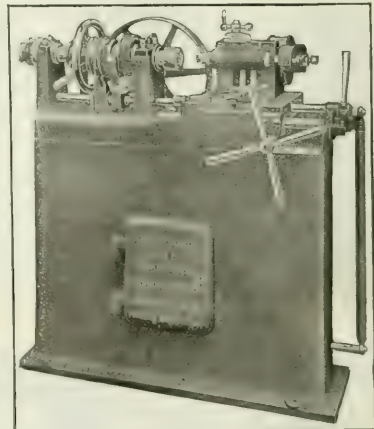
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**Complete Foundry Equip-
ments. Cranes of all Types.**



1719

The Morris Thomson Semi- Automatic Thread Miller



Simplest, fastest and most accurate for Primers, Fuse
Bodies, Watch Cases and such pieces. Capacity 3-inch
internal or external 10 pitch.

Quick Deliveries.

Hundreds in Use.

T.C.M. Mfg. Co., Harrison, N.J.
U. S. A.

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Every Sixty Minutes of Daylight Counts Just Now

Don't Waste Precious Minutes Need-
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Williams' "Agrippa" Threading Tool

with Lockable Spring Head can both prepare and finish a threaded piece. It affords either rigidity or flexibility as required and permits you to rough turn, finish and thread without removal from the tool post.

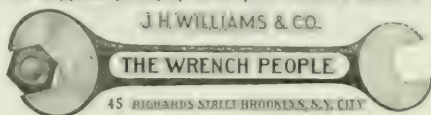
Machine tool time is now priceless. Conserve every moment possible by largely eliminating shaping, sharpening and shifting of tools.



Alloy
Steel Cutter

Use Only Williams' "AGRIPPA" Tool Holders
"THE HOLDERS THAT HOLD"

They can be supplied promptly from your dealer's stock or from ours



PRACTICALITY

AFTER fifteen years' study of the Miner's and Lumberman's wants, we know just what is and what is not required in tools for them.

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The use of best material and finest workmanship enable us to manufacture tools that are unexcelled.

We make a complete line.

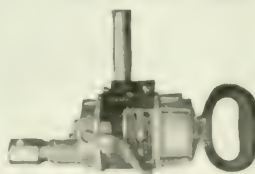
Write us for prices.

J. W. CUMMING & SON, LTD.
NEW GLASGOW, CANADA

Wood or Steel, let Cumming's make it

U. S. Electric Drills and Grinders

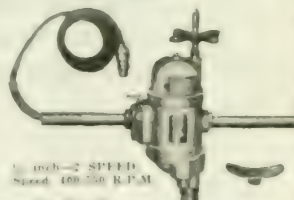
Save Time, Labor and Money



SIZES

3-16 in., W.G.T., 6 lbs.
1/4 in., W.G.T., 9 lbs.
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All machines mounted for
use on lamp sockets.
Drills are self-feeding
and steady.
For sale by
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary,
Vancouver.



1/2 inch—2 SPEED
Speed: 100-250 R.P.M.

For Sale By

The Canadian Fairbanks-Morse Co., Limited

Montreal, St. John, N.B., Toronto, Winnipeg, Calgary,
Vancouver.

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

If any advertisement interests you, tear it out now and place with letters to be answered.

The Munitions Worker's Grinder



The cut illustrates our No. 7 "LITTLE DAVID" Grinder, fitted with 21" Extension Shaft, housing and outer bearing. The grinding wheel is 6" x 1", of composition suited to the work, and its free speed is 3,000 r.p.m. Weight, 24 lbs.

This style of Grinder is just what you need for grinding the insides of High Explosive Shells, or any work where grinding, buffing, or touching up is to be done.

They are widely used in munitions plants, because they are **convenient, efficient and time-saving**. We use them in our own munitions work, and can tell you how to apply them to the best advantage. Ask our nearest branch for information and prices.

CANADIAN INGERSOLL-RAND CO., LIMITED

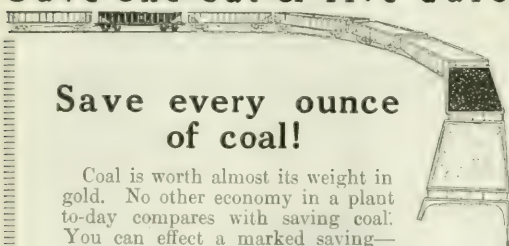
COMMERCIAL UNION BUILDING

MONTREAL, CANADA

SYDNEY TORONTO COBALT TIMMINS WINNIPEG NELSON VANCOUVER

Works: Sherbrooke, Que.

Save one out of five cars



Save every ounce of coal!

Coal is worth almost its weight in gold. No other economy in a plant to-day compares with saving coal. You can effect a marked saving—users say 20%—by utilizing every heat unit of your steam with the

Morehead Back to Boiler SYSTEM

By getting the value of every heat unit you do not have to use as much coal—and the efficiency of your plant is increased as well.

There is a MOREHEAD SYSTEM that will fit your requirements. Let us give you further information and prices.

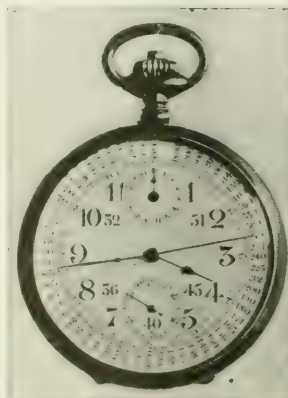
Canadian Morehead Mfg. Company

Dept. "L"

Woodstock, Ontario

417

Determine, Measure and Eliminate LOST TIME and MOTION



Master Chronograph.

With this Master Chronograph you may STANDARDIZE the operation. INSTRUCT 2 or 3 men to do a more profitable effect and MEASURE their work in terms of the new standard thus extracting from your present conditions an added profit without the expenditure of an extra dollar.

The Master Chronograph is the one device which will show at a single glance the total of its computation. The only stop watch that will reduce net cost to a figure of production per hour without the use of a pencil. It embodies a 12-jewel timepiece. Write for literature.

MORTIMER J. SILBERBERG
122 So. Michigan Avenue

Engineer
Chicago, Ill.

The day of advanced power only for the purpose of advanced profits has now passed.

To even-ize, or sell, the expense may be to save yourself into bankruptcy.

The one opportunity for the manufacturer to increase his profits is by a reduction of costs.

Labor in America will never sell itself cheaper than to-day, and the cost of materials is increasing yearly.

Therefore, increased profits in your plant are dependent upon just on thing:

You must determine, measure and eliminate lost time and motion.

The Master Chronograph will enable you to determine, without further calculation just what a man or machine (1915-19) and SHOULD DO in an hour or a minute.



That is a
HANNIFIN
Air Chuck

If your work requires quick handling and a rigid-slip grip, the chuck for the job is the "Hannifin" — increases output from 20 to 100 per cent.

*Catalog of Air Operated
Chucking and Clamping
Equipment on request.*

At the Worthington Pump and Machinery Corporation's Hazelton, Pa., plant, Hannifin Air Chucks are in sole possession of the field. The machine photographed shows a 3" Russian shell Hannifin-chucked for inside operations.

These chucks do their work under 75 pounds air pressure and "Aid greatly in speeding up production," says the master mechanic; for outside turning, shells are held on Hannifin Air Operated Mandrels with similar results.

In another busy shell department one operator reports an increase of ten 5" shells per day through the change to Hamflin Clucking, and considerably less fatigue when the day's work is done.

Hannifin Chucks are doing important work on every shell making "front" — also in other lines of manufacture.

HANNIFIN MFG. COMPANY, Chicago, U.S.A.

[illegible]

If any advertisement interests you, bring it to our attention and place with letters to the editor.

WHITMAN & BARNES

Twist Drills
and
Reamers

Screw and Drop
Forged Wrenches
Hammers

W

B

CO

Special
High Grade
Drop Forgings

Cotters
Chisels
Punches, Etc.

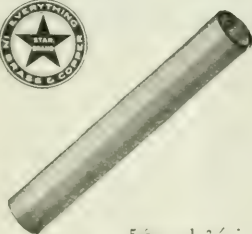
Users recognize "W & B" Tool Quality, backed by 62 Years' Uninterrupted Manufacturing Experience. If your Jobbers and Dealers cannot supply, write us and we will see that you are supplied. Send for Catalog No. 86-H.

THE WHITMAN & BARNES MFG. CO.

ESTABLISHED 1854

CANADIAN OFFICE AND FACTORY

ST. CATHARINES, ONTARIO



IN STOCK READY TO SHIP

"STAR BRAND"
SEAMLESS BRASS

CONDENSER TUBES

TINNED INSIDE AND OUTSIDE

5/8 and 3/4 inch O.D., No. 18 Stubs Gauge—12, 14, 16, 18 and 20 foot lengths
AND

"STAR BRAND" BRASS CONDENSER TUBE FERRULES

Standard 14 Thread for 5/8 and 3/4 in. Tubes

OUR STOCK ON HAND READY FOR IMMEDIATE SHIPMENT ALSO INCLUDES A FULL LINE OF REGULAR STOCK SIZES AND SHAPES OF THE FOLLOWING

"STAR BRAND" SPECIALTIES

Seamless Brass and Copper Pipe and Tubing, Brass Fittings, Sheet Copper, Copper Bar, Rods and Wire, Copper Nails, Sheet Brass, Brass Rods, Tobin Bronze Rods, Copper Rivets and Burs AND OTHER PRODUCTS IN BRASS, COPPER, PHOSPHOR BRONZE, ARCHITECTURAL BRONZE, ETC., ETC.

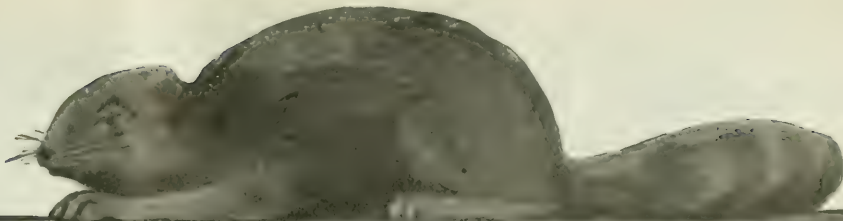
U. T. HUNGERFORD BRASS & COPPER CO.

BRANCHES:
BOSTON
BALTIMORE
PHILADELPHIA
SAN FRANCISCO

HUNGERFORD BUILDING
Lafayette, White and Franklin Sts.
NEW YORK, U.S.A.

KINDLY ADDRESS
INQUIRIES
FOR ATTENTION OF
DEPARTMENT D.

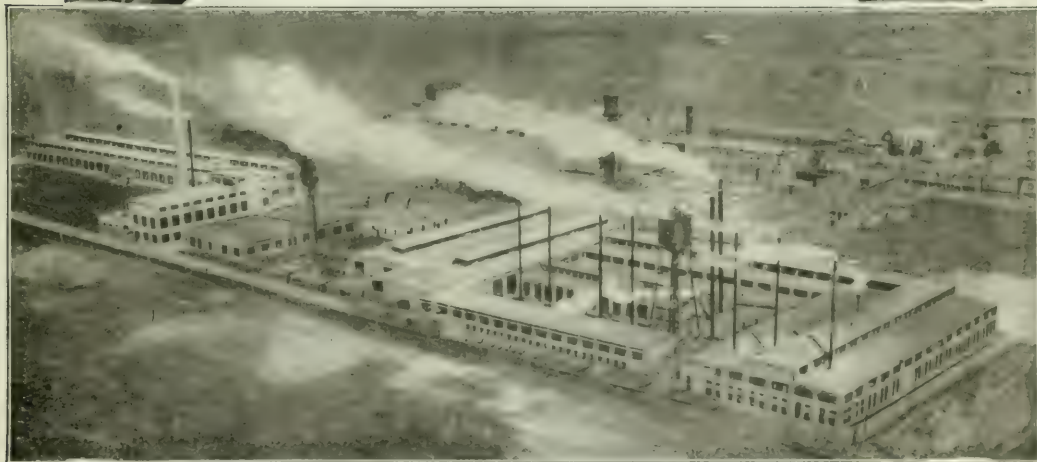
If any advertisement interests you, tear it out now and place with letters to be answered.



BROWN'S

BEAVER BRAND METALS

BRASS, BRONZE,
CANADA SILVER and GILDING METAL
In Sheets, Rolls, Plates and Rods



Brown's Copper & Brass Rolling Mills, Limited

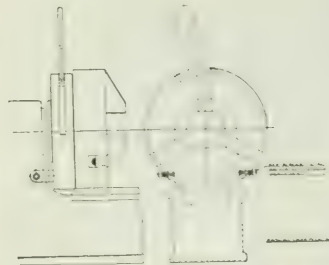
General Offices and Works:
New Toronto, Ontario, Canada



Barker Wrenchless Chuck

Study the Diagrams

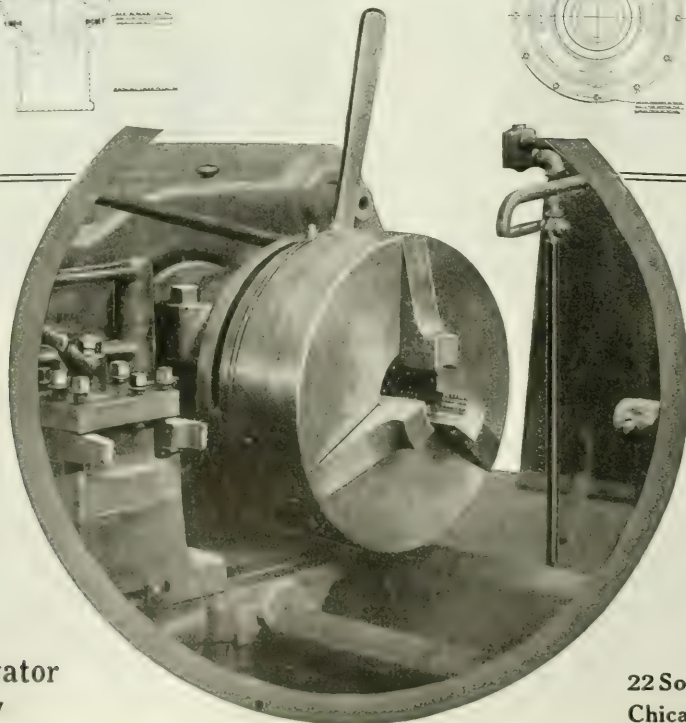
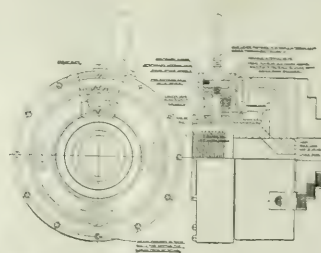
Diagrams can show you inner construction of "Barker" Chuck. The illustration can show it mounted. Look them over. Think them over. Operating mechanism and the chuck form a unit. Operating mechanism is in form of a planetary gear enclosed within a casing which is carried and held central by the hub of the chuck. Find these features in the diagram.



Adjusted Like a Face Plate

Adjusted on the headstock as easily as a face plate. It occupies 1-3 less space than an air operated chuck of like capacity. That lever will release jaws of chuck while machine is at any speed. The principle is correct. Our clients are high in its praise. Let us send you a list of the "Barker" installations near you. See it in operation yourself, then be convinced by practical proof.

Girls and women are successfully operating "Barker" Chucks in many Canadian and British shops. If YOUR agents are NOT carrying "Barker" Chucks write direct to



**Thomas Elevator
Company**

**22 South Hoyne Street
Chicago, Ill., U.S.A.**



The above illustrates a "Winfield" Butt Welder in the plant of a well known firm manufacturing automobiles

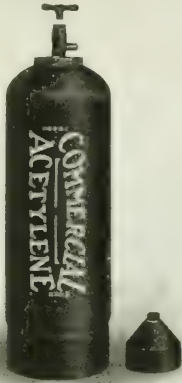
We desire to show you where and how such an installation can and will reduce your shop costs. Send us a few samples of your work, which we will weld and return for your inspection, or a blue print or a sketch will do. This will enable us to submit a detailed report for your consideration.

*WE MANUFACTURE A COMPLETE LINE OF ELECTRIC
WELDERS, BOTH BUTT AND SPOT TYPES*

THE WINFIELD ELECTRIC WELDING MACHINE CO.

WARREN, OHIO, U. S. A.

Electric Welding



Quality Quantity Guaranteed

Write US About Your
Acetylene Supply

Commercial Acetylene Welding Co., Inc.

ATLANTA, GA.
AURORA, ILL.
BOSTON, MASS.
BOUND BROOK, N.J.
EAST DEERFIELD, MASS.

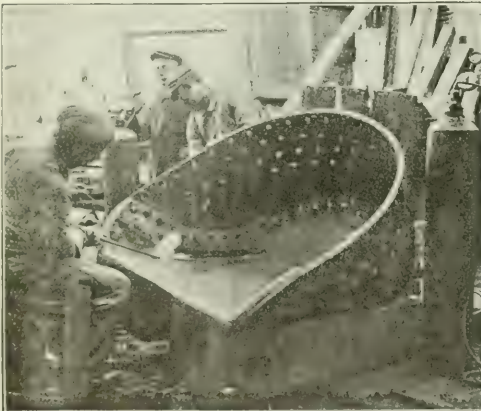
103 Bay Street, Toronto

Main Office

80 Broadway, New York

TORONTO, ONT.
SAN FRANCISCO, CALIF.
MOBERLY, MO.
W. BERKELEY, CALIF.

ADDING NEW METAL TO WORN-OUT PARTS BY OXY-ACETYLENE WELDING



Strengthening worn-out dredge bucket by Oxy-Acetylene Welding.

This is an important feature of the process and makes for greater economy. Any part of machinery, etc., that has become unusable by hard wear can be built up and made like new again. For reinforcing gear teeth, rejoining broken parts, castings, etc., its value can hardly be over-estimated.

The Cost of an "A.L.S." Oxy-Acetylene Welding Outfit is Small

It is absolutely indispensable in all Plants where running machinery is employed, and in many manufacturing Industries, or wherever the necessity of joining two pieces of metal for whatever purpose required.

If Efficiency and Economy mean anything
to you, investigate to-day.

Catalogue and Data Free on Application.

There is no risk in buying an "A.L.S." Welding Outfit. It is the result of years of scientific experiment and practical experience, and is backed by "A.L.S." Service—the best in Canada. A staff of experts and every facility to insure complete satisfaction.

L'AIR LIQUIDE SOCIETY

Pioneers of the Process.

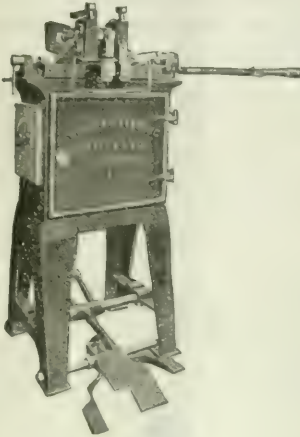
Factories the World Over.

TORONTO
16 Boler Street

MONTREAL
Cor. 1st Ave. and Erast

WINNIPEG
1297 Pine

Thomson Process
Electric Welding



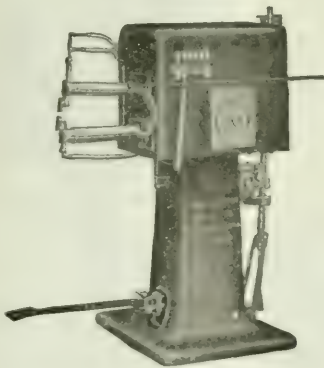
Economy—

In these times, when the entire country is endeavoring to conserve its resources to the greatest extent possible, you can eliminate waste in your welding department by installing a Thomson Butt Welder. The saving in six months will more than pay for the initial cost.

Whether you weld automobile rims, truck rods, angle irons, pipe joints, etc., there is a Thomson Butt Welder for YOUR purpose.

Send for Bulletin B-4.

The Thomson Spot Welder Does It Quickly



It has been proved by actual results that one day and a "Thomson" can do more and better work than five men and any other method.

It is extremely economical—no rivets to buy, no holes to punch. Think for a moment what that means in dollars and cents. It is just as easy to operate as it is economical—no danger, no smoke, no dirt and very little noise.

We have a model for your work.

Send for Bulletin S-4.

Thomson Electric Welding Co. Thomson Spot Welder Company
Lynn, Mass.

Canadian Sales Office, 311 Falls Street, Niagara Falls, N.Y.

Thomson Process
Electric Welding

If any advertisement interests you, tear it out now and place with letters to be answered.

These Two **TATE-JONES** Improved Portable Gas Oven Furnaces will Prove Money Savers in any Plant

Series A--Recuperative

For Temperatures of 900 deg. to 1600 deg. Fahr. Uses Natural or Artificial Gas. Low or positive pressure for Hardening Carbon Steel, preheating or reheating High Speed Steel.

For tool room or manufacturing purposes, this furnace is not only economical in its fuel saving features, but lends itself to various uses up to its temperature capacity.

It has been proven by scientific working tests that the recuperative device saves as high as 25% in fuel. It saves time and delivers a better finished product.

The interior of the oven is especially constructed so that 100% of both the radiant and radiated heat is thrown to the work. This is really 50% more than can be obtained from other furnaces.

The fire brick and specially molded tile are the best obtainable for the purpose. We use one inch of a special insulation that is equivalent to nine inches of fire brick in the prevention of heat loss. The outer casing of the oven is made of cast iron and boiler plate. The recuperator is constructed entirely of cast iron, sheet steel and high grade fire brick. The coil is 1 1/4" wrought iron pipe, so placed that no direct vent heat can strike it. This assures long life.

This line of furnaces has many points of economy and ease of operation that are more apparent in use than in the illustration.

Sizes and complete specifications upon request. Ask for Bulletin 160-C.

SERIES H.

For temperatures 1600 deg. to 2400 deg. Fahr. For hardening High Speed Steels. Uses Artificial or Natural Gas at 1-2 to 2 1-2 lbs. pressure. Especially valuable for hardening fine cutting tools and manufacturing uses.

The loss of heat by radiation is practically negligible because of the high quality as well as the particular kind of linings used. The 1" of special insulation is equivalent to 9" of fire brick (same as used in series A furnaces).

Because it requires no live heat to keep it in temperature equilibrium, it makes all the heat delivered, available for work. This, naturally, effects a big saving of fuel.

The outer casing of the furnace is cast iron and boiler plate. The door, owing to the slant construction, is always tight to the front; it overlaps, top, bottom and sides—all of which prevents leakage. There is no friction in opening the door. Raising it a fraction of an inch frees it from the front—when it rises straight up.

As a Pyrometer is absolutely essential in hardening high speed steels we supply a Pyrometer Bracket especially designed for this furnace. For preheating high-speed steels use Tate-Jones Series A Furnace (described on the left).

This Series H furnace can be supplied recuperative also, which means a saving of as much as 25% of fuel.

Sizes and complete specifications upon request. Ask for Bulletin 67-C.

TATE-JONES & CO., INC., Furnace Engineers
PITTSBURGH, PA., U.S.A.

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

Where Experience Counts

There is something new to be learned about the intricate problem of heat-treating every day. Over half a century's experience in burning liquid and gaseous fuels for treatment of metals has resulted in the present perfected type of G. & B. Furnaces.

There is a Gilbert & Barker Furnace for every purpose—made in over 100 types and sizes. We are able to make immediate deliveries on nearly all types.

Look over your heat-treating department carefully for leaks. You are almost sure to discover where you can save money on a G. & B. instalment. Take this tip seriously—you'll find it worth while.

Every piece of heat-treated steel you use in your plant should come from your heat-treating department in perfect condition—to absolutely guarantee this G. & B. furnaces should be used.

Gilbert and Barker furnaces installed in your heat-treating department gives you assurance of the most efficient and economical method of production in existence.

Put Your Heat-Treating Problems up to Us.

Write To-day for Stock List 24.

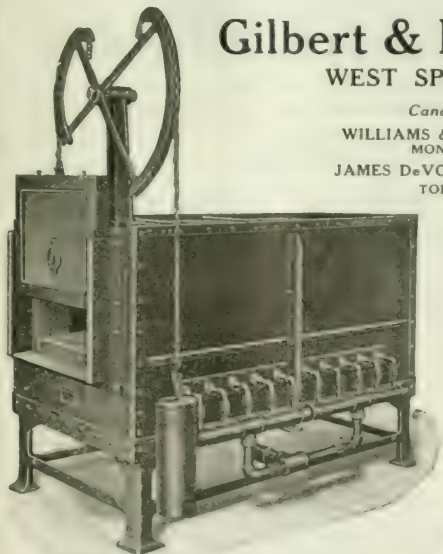
Gilbert & Barker Mfg. Co.

WEST SPRINGFIELD, MASS.

Canadian Agents:

WILLIAMS & WILSON, LIMITED
MONTREAL, QUE.

JAMES DeVON, 227 Davenport Rd.
TORONTO, ONT.

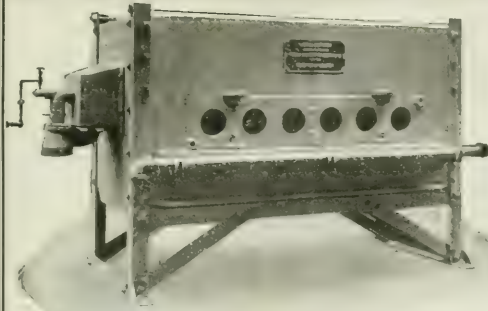


TYPE E C-25 FURNACE



TYPE C-15

If any advertisement interests you, tear it out now and place with letters to be answered.



“MECOL”

**6" Shell End Nosing
Furnace**

*We manufacture furnaces for all
purposes to be used with
any kind of fuel*

The Mechanical Engineering Company, Ltd.
THREE RIVERS, QUE., CANADA



Medal of Honor, Highest Award, Panama
Exposition. Made in Canada.

Why Use Compressed Acetylene

when you can generate your own acetylene at 50% less
cost and always have ample gas on hand?

Davis Acetylene Pressure Generators

Made in three types, the standard pressure generator in five sizes, with capacity of 25 lbs., 50 lbs., 100, 200 and 300 lbs. of carbide at each filling,—the portable pressure generator in 25 lb. and 50 lb. capacity sizes,—and the Navy Type two pressure generator with capacities of 100 lbs., 200 lbs., or 300 lbs. All pressure generators supply acetylene under pressure up to 15 lbs. The Davies acetylene-generator is on the approved list of the National Board of Fire Underwriters. Patented.

Generators of all sizes kept in stock.
Prices and Catalog on request.

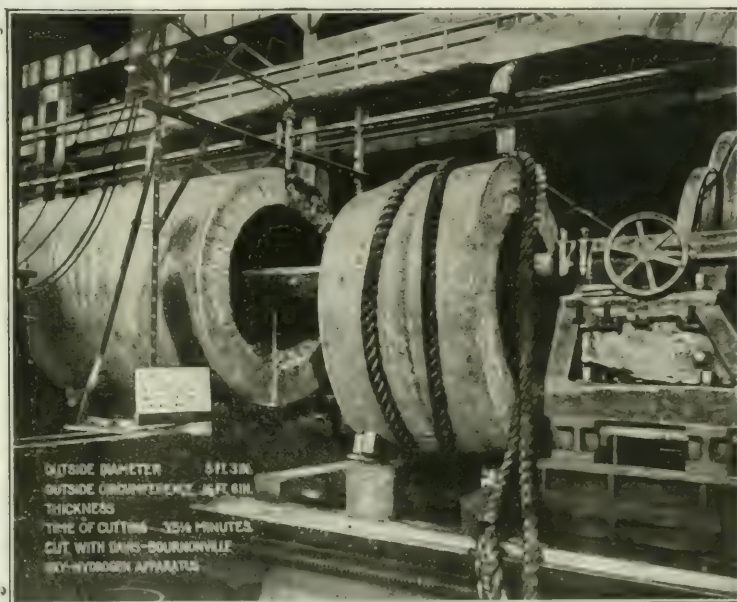
Carter Welding Company, Limited
9-11 Sheppard Street Toronto, Ontario

Canadian Agents for

THE DAVIS-BOURNONVILLE APPARATUS

Mention this paper when writing advertisers. It will identify the proposition about which you require information.

50,000 lbs. 5-ft. 3-in. diameter. 9½-in. thick. How Did They Cut It In 35½ Minutes?



(Photo by New York Shipbuilding Corp.)

It was cut with a torch and gas flame — Davis-Bournonville Oxy-Hydrogen Cutting Apparatus — in the New York Shipbuilding Yards; a cast steel rotor 14½ in. thick at the head, 5 in. thick at the foot, 9½ in. thick and 5 ft. 3 in. diameter where it was cut — cut slick and clean, as shown in the illustration, in 35½ minutes' cutting time. It would have taken many hours, and been a considerable problem by any other method. Davis-Bournonville Oxy-Acetylene and Oxy-Hydrogen Apparatus is applied successfully to the problems in metal working, and is in use by most of the big metal-working concerns—foundries, steel mills, ship yards, navy yards, locomotive and car shops, munitions plants, sheet metal-working factories, etc. Make inquiry about it, or write us.

"Davis Apparatus" Leads the World in Range,
Efficiency and Number of Successful Users.

DAVIS-BOURNONVILLE COMPANY

General Offices and Factory, JERSEY CITY, N.J.

CARTER WELDING COMPANY, GENERAL DEALERS, TORONTO

Canadian Factory, NIAGARA FALLS, ONTARIO

New York
Philadelphia
Cleveland

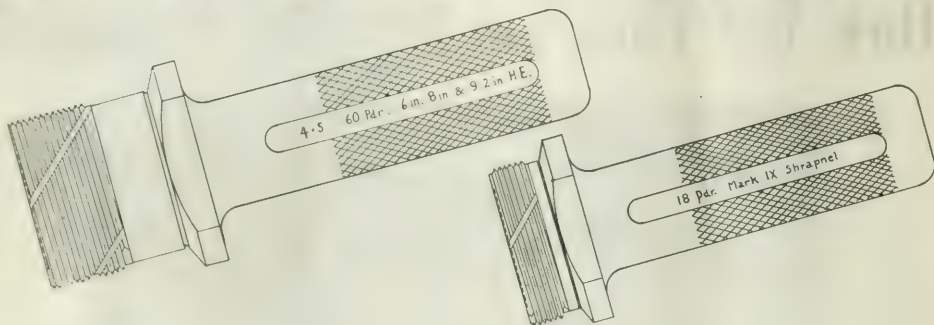
Pasadena
Pittsburgh
Cincinnati



Chicago
St. Louis
San Francisco
Portland
Seattle
Boston

If any advertisement interests you, send it to our office with letter to be answered.

FUSE HOLE GAUGES



Manufacturing and inspection fuse hole gauges for all size shells. A surplus stock enables us to ship immediately.

Windsor Machine & Tool Works

Windsor, Ontario

**SHEET
METAL
STAMPINGS**

**Dominion Forge
& Stamping Co., Limited**
WALKERVILLE ONTARIO

**DROP
FORGINGS**

Our facilities
and equipment enable us to
give you a top-notch quality at a very
reasonable price.

AUTOMOBILE FENDERS, HOODS AND GASOLINE TANKS

The Oven Equipment & Manufacturing Company
NEW HAVEN, CONN.

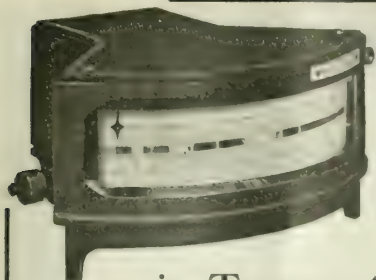
"CRAWFORD SECTIONAL" OVENS

Heated with our Enclosed Flame Gas Burners, or Electricity
FOR BAKING JAPANS AND OTHER FINISHES ON METAL.

Ovens carried in stock and built to meet requirements of manufacturers.

Builders of All-Steel Oven Trucks with Roller Bearings.

Canadian Representatives: **The A. R. WILLIAMS MACHINERY COMPANY, Ltd.**
ST. JOHN, N.B. TORONTO WINNIPEG VANCOUVER



If You have a Prob- lem

in Temperature

Let us consult with you. Tell us your requirements and let us help with your proposition. We manufacture temperature instruments for all departments of metallurgy and chemistry, standard apparatus of precision, reliability and permanence.

Tycos Fery Radiation Pyrometers.

Rare Metal Thermo-Couples

Cover 1000° to 2500°. These instruments have repeatedly proven themselves equal to the most severe conditions. Their ruggedness, sensitivity, or any service in range. Send for "Booklet 1000."

Base Metal Thermo-Couples

Ranges from 200° to 1000° and 300° to 1800°. Practical, accurate shop tools requiring no special skill or intelligence in operation. Write for booklet, "Pyrometry."

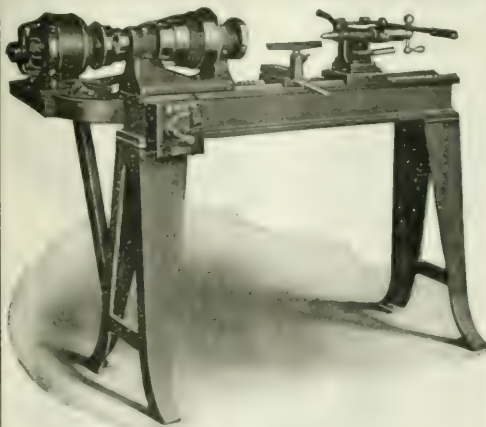
"*Tyco's Cambridge Pyrometry.*"

Tayler-Cambridge Division

Taylor Instrument Companies

Rochester, N. Y.

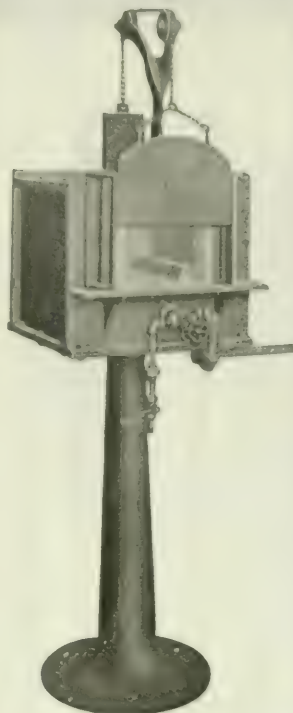
201 Royal Bank Bldg., Toronto, Can.



Built For Service

THE HISTORY of Americanism, both of our nation and of our social system, is a very simple, and yet a matter of fact, history, and one is surprised to find that it has not been so generally treated. The history of Americanism is a very simple, and yet a matter of fact, history, and one is surprised to find that it has not been so generally treated. The history of Americanism is a very simple, and yet a matter of fact, history, and one is surprised to find that it has not been so generally treated.

J. G. Blount Co., Everett, Mass., U.S.A.



General Tool Work

Built to meet the necessities of the small machine shop, or the plant where the needs of a furnace of this character are limited. Its size does not affect the inherent quality that is embodied in all "Bellevue" Furnaces.

May be operated by oil or gas. The greatest amount of heat is taken from either fuel. This feature is one that has convinced the "Belloyne" Furnaces "solid" with their users. Combustion is perfect. No flames come in contact with the material.

Our catalogue is at your disposal.

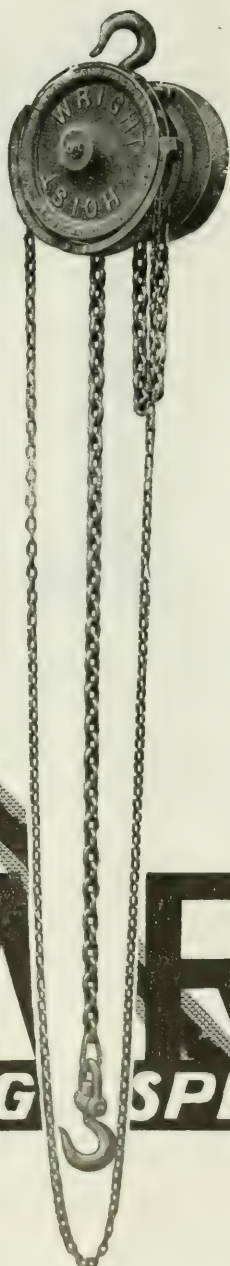
Bellevue Industrial Furnace Company

John C. Hines, President

703 Bellevue Ave., Detroit, Mich.

Canadian Representatives

H. W. Petrie, Limited, Toronto



TWO distinct features single the Wright High Speed Steel Hoists out as above the average and possessing qualities that promote efficiency and reduce cost and danger.

The Steel and Malleable Iron Construction on points of stress have so eliminated the breaking danger under heavy loads that absolute confidence may be placed in it wherever in use.

The Non-Fouling Chain Guide permits the raising and lowering from any angle and that jerky motion and catching of the chain is entirely eliminated.

In the Canadian munition plants hundreds of Wright Hoists have been installed. This speaks volumes for its ease and efficiency.

The fact that we claim it is a "never-break" hoist speaks for its strength.

"Write Wrights" about your hoisting.

Wright Mfg. Company
LISBON, OHIO, U.S.A.

Canadian Agents: The A. R. Williams Machinery Co.,
Limited, Toronto, St. John, N.B., Winnipeg, Vancouver

WRIGHT
HIGH SPEED STEEL HOISTS

**STEEL HOISTS
NEVER BREAK**



Maximum Power With Minimum Belt Slip

The pulley question is a vital one. Slipping belts and wind running pulleys are responsible for big power losses in many factories and mills.

A steel pulley—an iron pulley—a wooden pulley; that's the way many pulleys are bought. The result is waste of power.

Stop this waste. Specify

AMERICAN STEEL SPLIT **PULLEYS**

These pulleys save power because their flat, A braced arms minimize wind resistance.

Because the grooved air escape in their face diminishes the air cushion under the belt.

Because they can be lighter with great strength.

Because they require the least amount of time for installation.

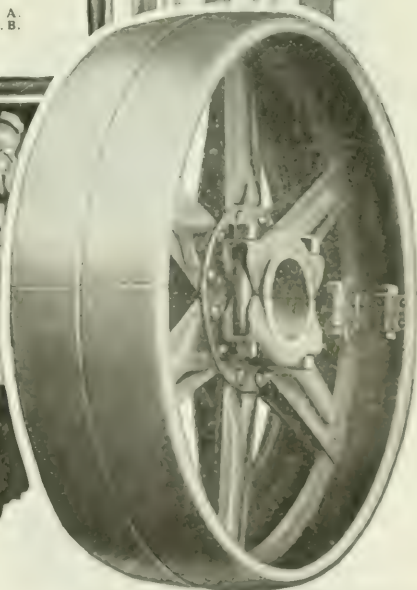
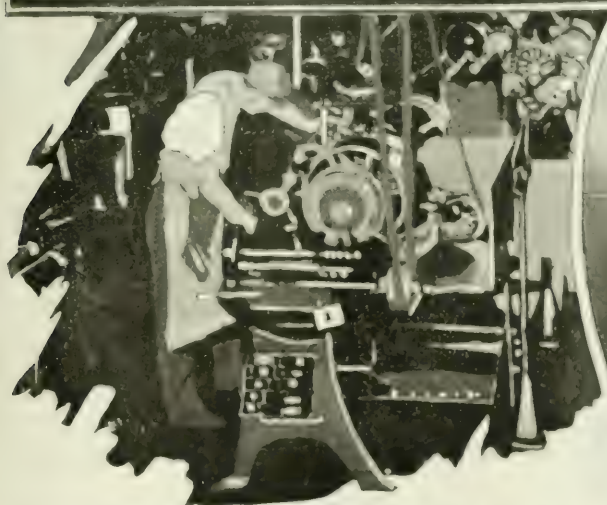
The belt grips the whole face of the pulley except the grooved air escape, and exerts the maximum pull. American Pulleys will not work loose on the shaft under severe intermittent loads—a frequent cause of the belt slip when wood or heavy iron pulleys are used.

Write for the Free Book "Pulley Efficiency"—a valuable treatise on pulleys.

AMERICAN PULLEY COMPANY


Philadelphia, Pa.

Canadian Distributors: Williams & Wilson, Ltd., Montreal, Que. A. R. Williams Machinery Co., St. John, N.B.; Toronto, Ont.; Vancouver, B. C.; Winnipeg, Man. H. W. Petrie, Ltd., Toronto, Ont.



If any advertisement interests you, tear it out now and place with letters to be answered.

Scandinavia Belts



Can be used anywhere that leather can be used.

Scandinavia Belting is a solid woven cotton belt, made of long fibre cotton. It is impregnated to give further solidity, and the impregnation also acts as a moisture resistant. For direct drives where atmospheric conditions remain approximately the same, this belt is probably the best on the market to-day.

It stands up well on shifters.

W. P. BENNETT
51 Montfort Street, Montreal, P.Q.

Beltings Packings Asbestos

Try a Trahern and be convinced

Our pumps will pump any lubricant that does not contain grit; operate against or without pressure—throwing a uniform stream of coolant free from pulsation, in reality performing the functions of two types of pumps; therefore, they are the logical pumps for your machines.

Write for particulars.

TRAHERN PUMP COMPANY
ROCKFORD, ILLINOIS

Canadian Agents: **A. R. WILLIAMS MACHINERY CO.**
Toronto, Ontario

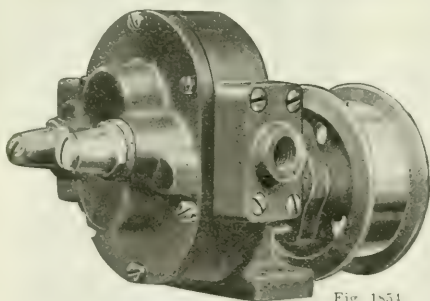


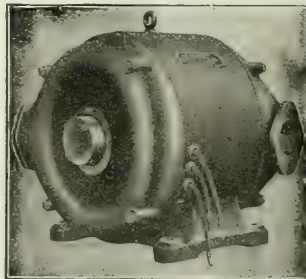
Fig. 1854

The Lancashire Dynamo & Motor Company, of Canada, Limited

107-109 Duke Street, TORONTO

ELECTRICAL MACHINERY for all Purposes.

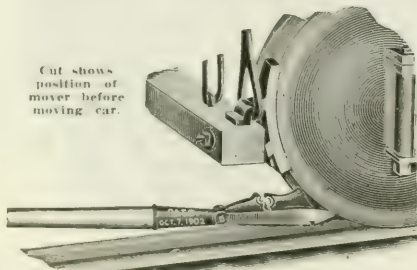
ELLIOTT BROS. (INSTRUMENTS
RECORDING GAUGES)



PIPE VENTILATED A.C. MOTOR
FOR VERY DIRTY PLACES

THE "SAMSON" RAILWAY CAR MOVER

Cut shows position of mover before moving car.



Every railway siding should be supplied with one of these tools. Takes the place of fifteen men and puts the heaviest loaded car just where you want it. It will pay for itself in 30 days.

It is one of the most simple and powerful devices for moving cars by hand.

It is provided with Never-Slip Spurs, which is the most important feature on a Car Mover.

Special attention given to export orders.

Dillon Manufacturing Company
Oshawa, Ontario

Eastern Sales Agent
Alexander Gibb
3 St. Nicholas St., Montreal, Que.

Western Sales Agent
D. Philip
138 Portage Ave., Winnipeg, Man.



CHAPMAN

Double Ball-Bearings effect an average total saving of power 15 per cent. to 30 per cent.

And reduce lubrication 95 per cent.

If you are in need of more power, they will give you 15% to 30% more without adding to your plant.

USED IN OVER 2000 CANADIAN FACTORIES

We recommend that you write some of these factories and find out what they think of our transmission ball-bearing service—we'll gladly furnish the names.

Chapman Double Ball-Bearings fit any adjustable hanger, and the change can be made quickly and with but little delay to you.

THE CHAPMAN DOUBLE BALL
BEARING COMPANY OF CANADA
LIMITED

339-351 Sorauren Avenue
TORONTO CANADA

Transmission Ball Bearing Company.
1050 Military Road, Buffalo, N.Y.



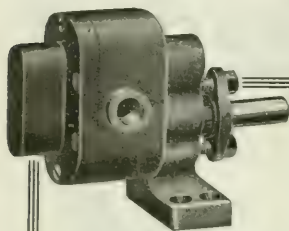
Did you ever notice somebody starting a conversation in a low voice with the two words "They say"? The moment you hear it you know it is gossip, scandal, and most likely a lie. But when you hear everyone saying that HARRIS HEAVY PRESSURE is the best BABBITT METAL they can use for all general machinery bearings, isn't it about time to believe them?

Send to our nearest factory for a trial box.

Manufactured and guaranteed by

The Canada Metal Company, Limited

Hamilton Montreal TORONTO Winnipeg Vancouver



**Speed
Up —**

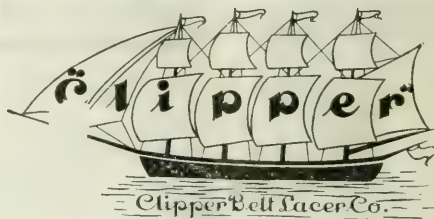
You can speed up that machine to its highest capacity and rest assured that Roper's Circulating Pump will keep the machine well oiled.

The machine is so constructed that the lubricant will flow in a steady stream, no halting, pulsating movement at all. This is a feature well worthy of notice. The circular is made in 6 sizes and will adjust itself to any size machine. The pump shown is a one-way lubricator only. We make the other kind.

Inquire.

C. F. ROPER & CO.

HOPEDALE : MASS. : U.S.A.

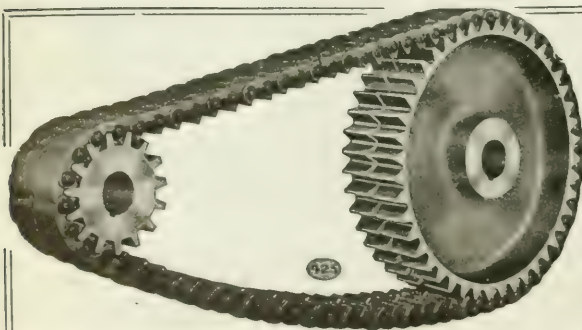


If you would use a stop watch while one of your belt lacing crews were at work you would find that you were paying expert men for a half hour job when any machine operator can lace a belt in **THREE** minutes with the

CLIPPER BELT LACER

CLIPPER BELT LACER COMPANY

976 Front Ave., N.W. Grand Rapids, Mich.



RENOLD CHAINS
The proven efficient form of Power Transmission.
PATENT SILENT

Equally suitable for main shaft or machine drives. Save space and power, increase output and ensure durability.
Chain and Parts Carried in Stock.

Sole Canadian Agents

Jones & Glassco. (Reg'd)

Branch Office: **ENGINEERS** St. Nicholas Bldg.
TORONTO, ONT. **MONTREAL, P.Q.**



Why pay 50% more than is necessary for unloading your Pig Iron when you can save that percentage by using MATHEWS GRAVITY PIG IRON CONVEYOR? Write for our Bulletin C.

CANADIAN MATHEWS GRAVITY CARRIER CO., Ltd.
484 RICHMOND STREET W., TORONTO

STEEL

Steel Tubing, Butted and Welded for Bedsteads, Agricultural Implements, Trolley Arms, Fence Posts, Etc.

14 to 20 gauge.

Sizes $\frac{1}{8}$ " to 2" outside diameter.

Let us send you samples

We are equipped with facilities for turning out big orders with the utmost dispatch. Prompt deliveries is one of our specialties.

Standard Tube & Fence Co.

Woodstock, Ontario

TUBING

GRATON & KNIGHT

Standardized Series

LEATHER BELTING

Tanned by us for belting use

It Begins in the Tannery

Leather is the Standard Belting Material

To us, the largest belting makers in the world, every possible belting material lies open for selection and use. But the belting experience of generations points to the unescapable fact that leather has the properties necessary to make good belting.

Leather that is properly tanned for belting is tough, flexible, durable and prehensile. It preserves the natural softness and mobility of the skin, ensuring an effective grip on the pulley surface.

We have standardized these requirements of perfectly tanned belt leather. The standard in each case is the highest working efficiency in the finished belt.

Since the market cannot supply tanned belt leather that continuously measures up to Graton & Knight Standards, we tan our own hides. Last year, we tanned 285,000 of them, in our own tannery. We tanned them for belts. We tanned them to definite and uniform standards of belting requirements.

This standardization of material is the foundation of Graton & Knight quality.

It makes the Standardization of Graton & Knight Belts an actual, practical thing.

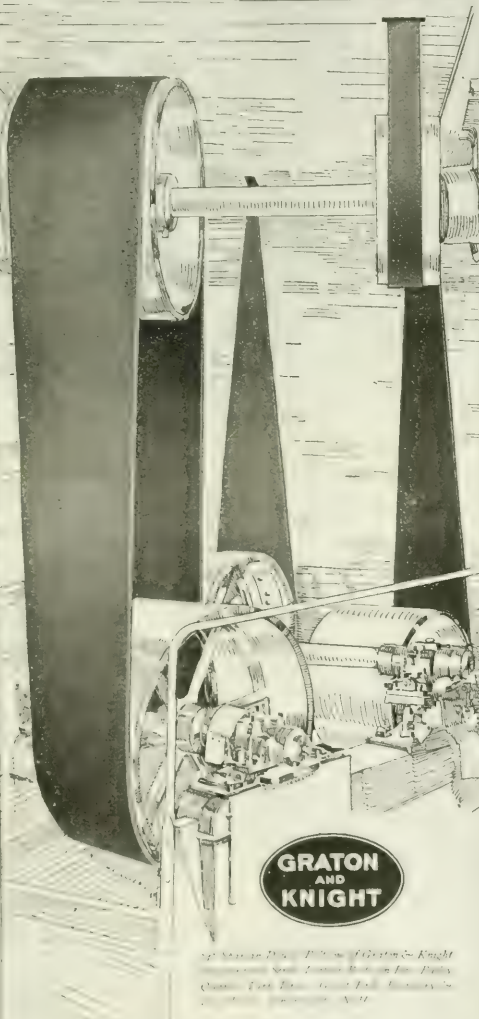
Think what other standardized products have done for you—and consider the standardization of belting on that basis. Let us send you complete information on the subject.

THE GRATON & KNIGHT MFG. COMPANY

*Oak Leather Tanners, and Makers of
Leather Belting*

Worcester, Massachusetts, U.S.A.

Canadian Representatives: The Canadian Fairbanks-Morse Co., Limited, St. John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Windsor, Vancouver, Winnipeg, Victoria.



Representatives: The Canadian Fairbanks-Morse Co., Limited, St. John, Montreal, Ottawa, Toronto, Hamilton, Quebec, Calgary, Saskatoon, Windsor, Vancouver, Winnipeg, Victoria.

When Work Goes Smoothly



BOWSER

Oil Storage Systems

assist in many ways to aid production, produce economy and efficiency wherever oil is used.

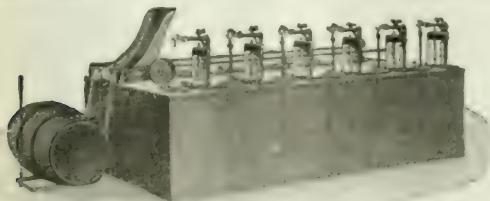
They provide effective storage and handling facilities for all kinds of oils. Keep oil clean, retain its value, prevent waste, and encourage the proper use of oil, which results in better work with less effort.

Outfits can be placed where most convenient, saving time and trouble.

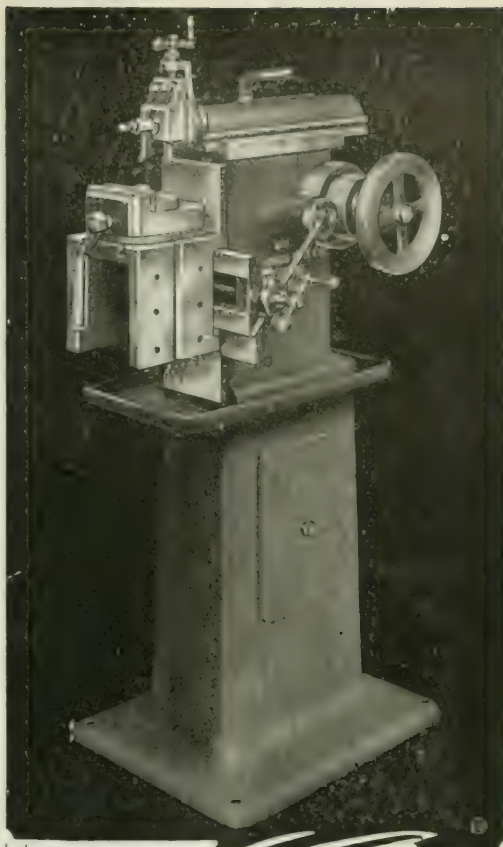
They are accurate, durable and safe; every shop needs the Bowser.

S.F. BOWSER & CO., Inc.

Sales Offices In all Centers **TORONTO, ONT.** Representatives Everywhere



A System For Every Need



"It speaks for itself. A silent story of quality." Vertical or Horizontal Shaper that will undertake to reduce your production costs more than you thought they could be reduced. Shaping, slotting, tool making, die making, modeling and other classes of light work that are profit-eaters when done on large machines.

This Rhodes machine will "eat them up," with accuracy, speed and economy. These machines are being established and stamped by business opinion as cost-cutting machines.

If you are your employer and thus want more valuable information.

The Rhodes Mfg. Co.

Hartford, Conn., U.S.A.

If any advertisement interests you, tear it out now and place with letters to be answered.

CANADIAN MADE

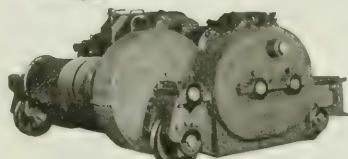
CANADIAN MADE

Electric and Hand Traveling Cranes



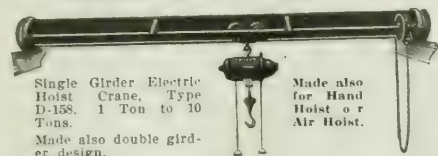
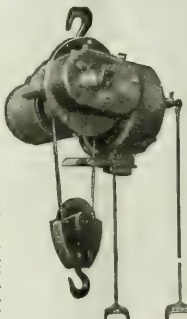
Type E-3 Motor Electric

Travelling Crane, 2 Tons to 100 Tons.



Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.



Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons.

Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

Type D Electric Hoists — ½ to 10 Tons.

Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.



CURTIS, St. Louis, U.S.A.

AIR COMPRESSORS — AIR HOISTS — TROLLEYS AND TROLLEY SYSTEMS—SAND BLASTS—PNEUMATIC AND HYDRO-PNEUMATIC ELEVATORS—JIB AND TRAVELING CRANES.

We have specialized for over 22 years on pneumatic machinery. We have developed the simple air cylinder into a straight line motor with wonderful speed control and dependability capable of the widest application to hoisting problems.

Our new controlled-splash oiling system with regulatable sight feed cylinder oiling is something entirely new in air compressor design.

Complete catalogs and descriptive circulars on our entire line furnished on request.

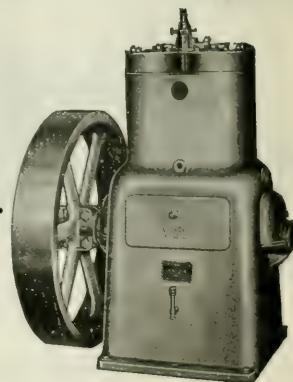
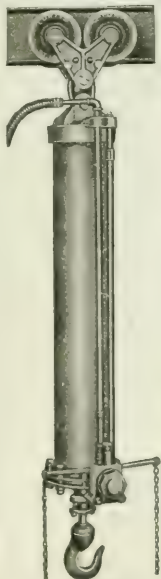
Curtis Pneumatic Machinery Co.

1585 Kienlen Avenue

St. Louis, U.S.A.

New York Office

532F Hudson Terminal





"Pioneer" STEEL HANGER

A Man's Job

Erecting cast-iron hangers is a man's job — and what is more, it doesn't take much of a hanger to require *two or three* men to get it into position.

A "Pioneer" Pressed Steel Hanger weighs only one-third as much as a cast-iron hanger; it has greater strength and costs no more; it can be erected by one man easily.

Why not, therefore, use "Pioneer" Hangers?

Have you a copy of our new booklet "Transmission Data"? It is worth studying. Mailed promptly for the asking.

Standard Pressed Steel Company

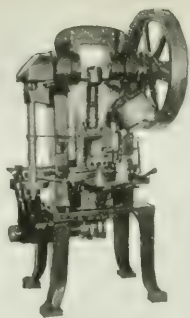
Philadelphia, Pa., U.S.A.

Sole Distributors for Ontario: H. W. Petrie, Ltd., Toronto, Ont.

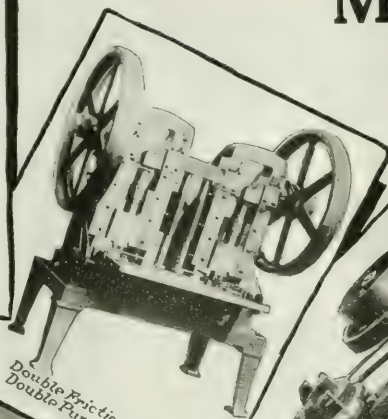
If any advertisement interests you, tear it out now and place with letters to be answered.

CARTRIDGE MACHINERY

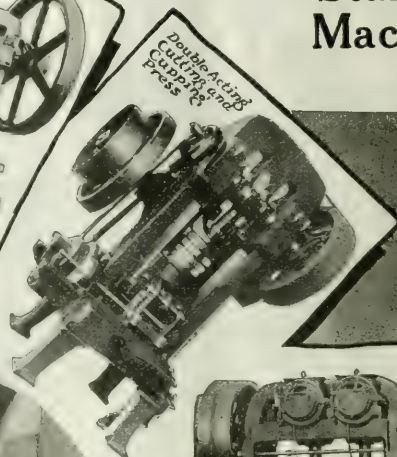
Waterbury Farrel
Standard
Machines



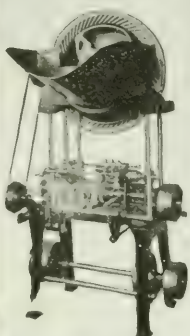
*Ratchet Dial
Bullet Assembling
Machine*



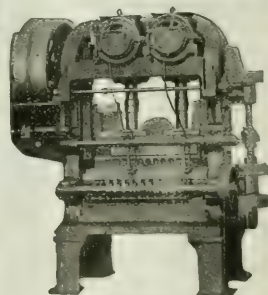
*Double Friction Dial
Double Punch Press*



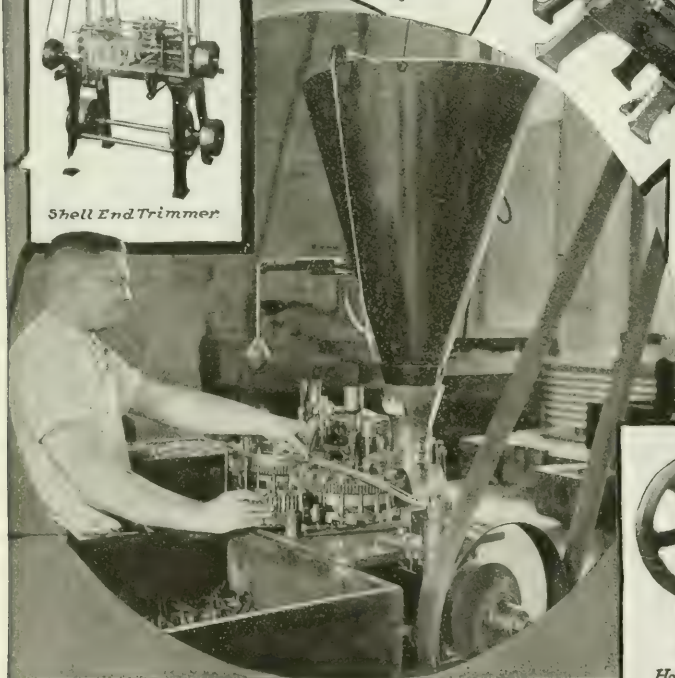
*Double Acting
Cutting Engine
Press*



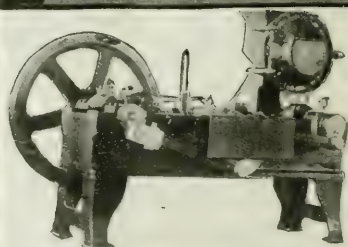
Shell End Trimmer



*Straight Line
Bullet
Assembling Machine*



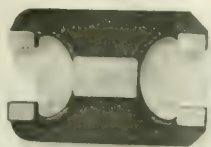
Standard Loading Machine in Government Arsenal



Horizontal Header Hopper Feed

The Waterbury Farrel Foundry & Machine Co., of Waterbury, Conn., U.S.A., has appointed me to be the sole manufacturer for export of their entire line of Cartridge and Shot Shell-Making Machinery. Proposals and Estimates covering complete plants or separate units, required for export will be furnished on request.

FREDERICK S. BLACKALL, Woolworth Tower, New York, U.S.A.



Double-end External Limit Gage



Single-end External Gage



Adjustable Limit Gage

Taft-Peirce Tool Room Specialties



The Taft-Peirce Mfg. Company

Woonsocket

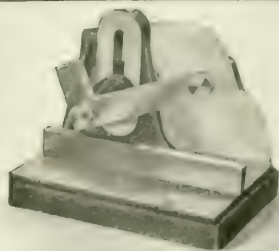
Rhode Island

NEW YORK, 233 Broadway
DETROIT, 1311 Majestic Building

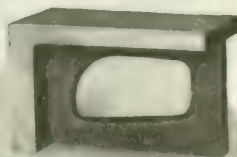
IN Taft-Peirce Tool Room Specialties we offer accessories needed in every tool room where accurate work is performed, devices designed and manufactured to replace those you have heretofore made yourself to facilitate machining or inspecting operations. We have standardized these tools, manufacture in quantities and can sell them at prices much lower than the cost of home-made devices. The line is quite complete also arranged to meet most requirements.

The T-P Double-end and Single-end External Limit Gages are particularly strong and durable and have large wearing surfaces. T-P Angle Plates will be found highly useful in laying out work, irregular shapes in particular. The Sine-bar Fixture shown is arranged with a supported sine-bar which is set on end to obtain the sine of the complement of any required angle between 45 and 90 degrees.

Catalogue "E" shows and describes the complete line. Send for a copy.



Sine-Bar Fixture



Universal Right angle Irons

If any advertisement interests you, tear it out now and place with letters to be processed.



Consolidated Presses

appeal to discriminating users because of the massive construction of all working parts, the generous crank shaft bearings, the increased diameter of crank pins, liberal crank cheeks, long and carefully fitted slide bearings, abnormally large connection screws, powerful gearing, and above all, the skill and care exercised in their construction.

These are features which should be considered when purchasing.

Consolidated Press Company

HASTINGS

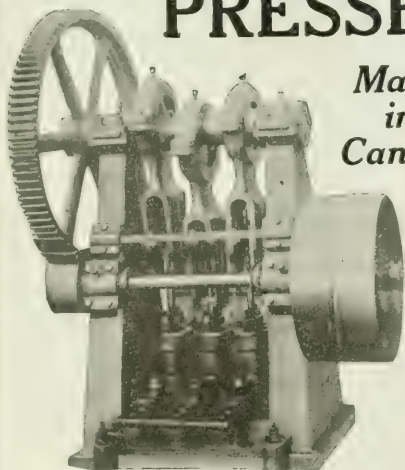
LARGEST EXCLUSIVE MANUFACTURERS OF POWER PRESSES IN U.S.A.

MICHIGAN

Canadian Representatives: A. R. WILLIAMS MACHINERY CO., Limited, Toronto, St. John, Winnipeg, Vancouver

PRESSES

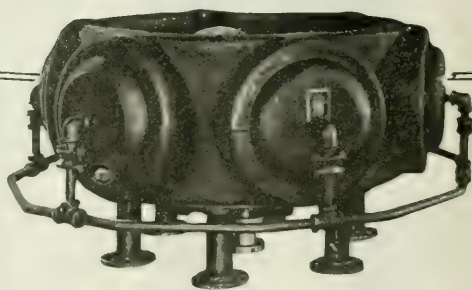
Made
in
Canada



Hydraulic Presses, Pumps and Accumulators for all purposes

WRITE FOR PRICES AND DELIVERIES

WILLIAM R. PERRIN, Limited
TORONTO, CANADA



Banding 6" to 12" Shells

Its sturdy construction allows it to stand up under severe service. This is the reason for its higher price. Such extra care, better material and expert workmanship are required that the results warrant the high cost.

It has six 11" semi-steel rams which move $\frac{1}{2}$ " or more if necessary. All rams returned by levers on plates with heavy Vanadium Steel Springs. Cylinder removable of alloy steel.

Hydraulic inlet to cylinder $1\frac{1}{2}$ " pipe. Distributing ring 2". All pipe of Seamless Steel Tubing. All fittings dropped forged steel. All parts under strain, alloy steel castings and forgings.

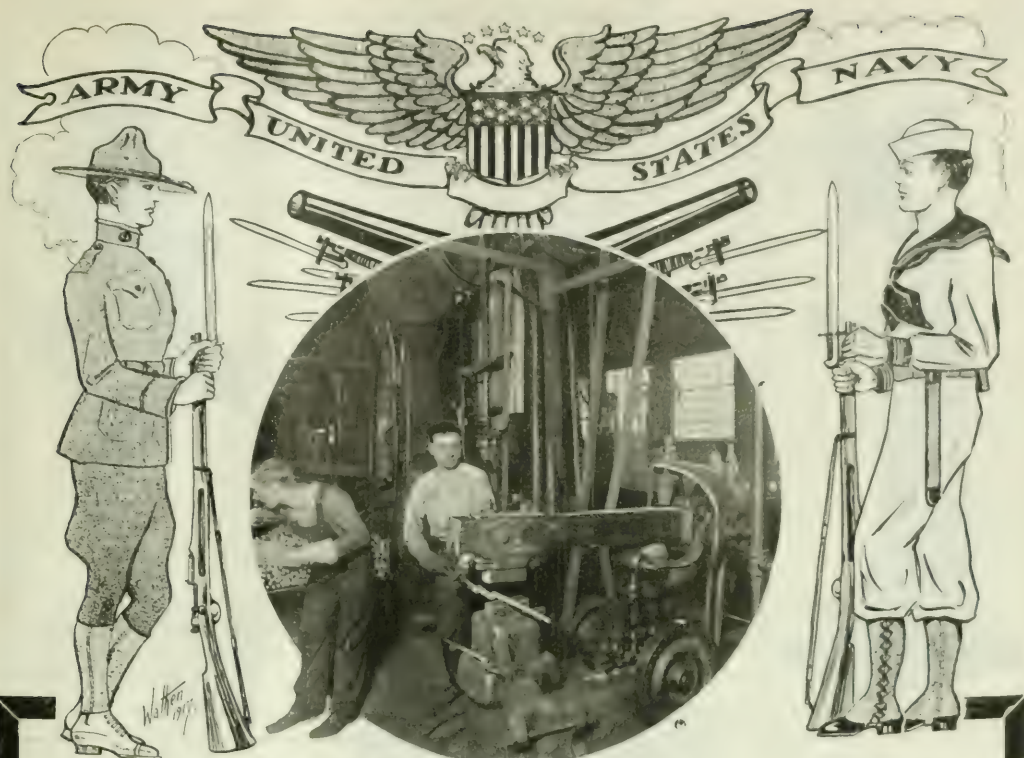
Six dies of forged chrome nickel steel, hardened and removable, without disturbing any part of press, by loosening two nuts. Can be operated either from accumulator or pump.

Built also in smaller size of same type for banding "pounder" to 6" shells.

Metalwood Manufacturing Co.

Leib and Wight Sts. -- DETROIT, MICH.

For Great Britain and Continent, address Gaston E Marbaix, Coronation House, 4 Lloyds Ave., London, E.C., England.



The Bradley Cushioned Heave Hammer

Forging Uncle Sam's "Toothpicks"

Interior of a large arms plant somewhere in the "United States," making bayonets destined as the final argument to uphold our national honor and dignity. Work must be both accurate and low-costing.

BRADLEY HAMMERS

are used for many kinds of forging work—for big production on duplicate parts where continuous service is essential.

Bradley hammers are easy on the hammer man and always under ready control. Pressure on the foot treadle, extending around front and both sides of the hammer base, operates an idle pulley against the down-traveling side of a continuous loose belt, and sets the hammer in motion. As treadle is released a brake stops the hammer.

C.C. BRADLEY & SON, Inc., Syracuse, N.Y.

FOREIGN AGENTS: France, Belgium, Switzerland, Spain and Portugal, Societe Industrielle & Com. S.A. 100, Rue de la Paix, Paris; Guala, Modena, Italy; Emanuel, Bonn & Huisman, Whitechapel Road, London.

If any advertisement interests you, tear it out now and place with letters to be answered.

Your Riveting?



How is it done? Are you getting the necessary speed? Is the quality of the highest character? How much is it costing you?

The Grant Rivet Machine has established the records of one clean, perfectly finished rivet per second. Is that speedy enough, or is it too speedy? This is the fastest any similar machine will work and if too speedy it could be worked in conjunction with some other work.

Our catalogue is worth writing for. There is one for you.

THE GRANT

Mfg. & Machine Co.
Holland Ave.
Bridgeport Conn.

HIGH SPEED HAMMERS

For High Speed Work

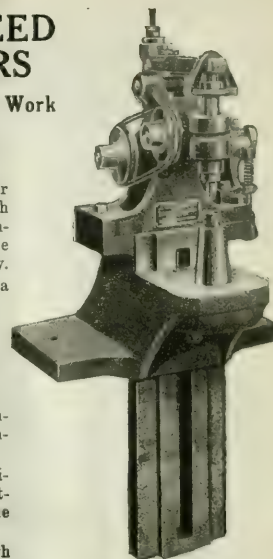
FEATURES:

Our Bench Hammer can be adjusted high or low, and spells another economy in space and handy utility.

With it you have a guaranteed saving of from 15% to 20% on any class of work. The life of the machine is practically indefinite as phosphor bronze bushings are used throughout.

No riveting too intricate for us; no riveting which our machine cannot accomplish.

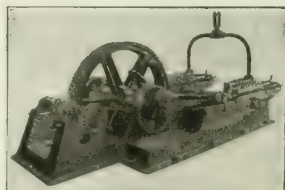
Send for our High Speed Hammer Book.



THE HIGH SPEED HAMMER CO.

Rochester, N.Y.

Sales Agents: The A. R. Williams Machinery Company,
Limited, Toronto, Ontario.



ELMES

18" Stroke Hydraulic Pump

for maximum pressures and capacities, for 250 horse-power motor—a pump designed to meet the demand for a high-pressure outfit of large capacity, and one able to withstand the severe usage of present-day practice.

Other designs for all pressures and capacities.

Charles F. Elmes Engineering Works

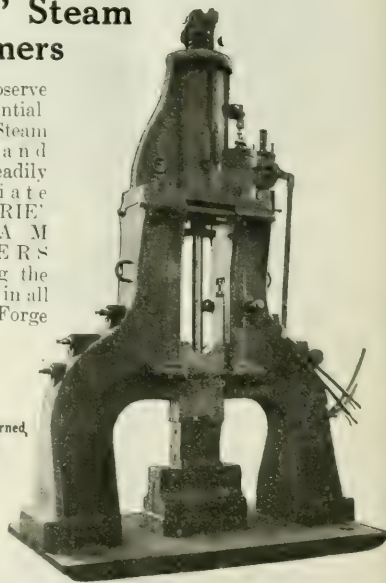
217 No. Morgan Street

CHICAGO, ILL.

"Erie" Steam Hammers

Closely observe this substantial well built Steam Hammer and you will readily appreciate why "ERIE" STEAM HAMMERS are getting the preference in all modern Forge Shops.

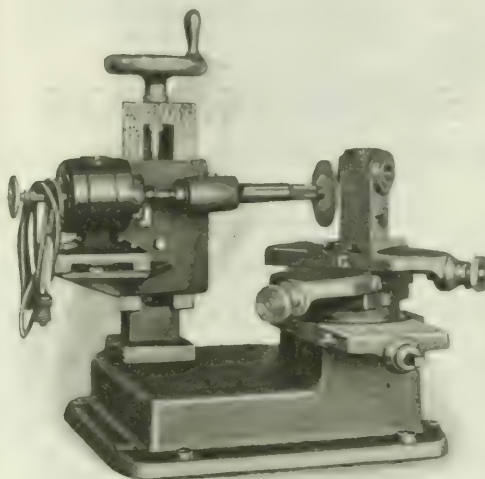
They have earned their enviable reputation.



ERIE FOUNDRY COMPANY
ERIE, PA. U. S. A.

The Cleveland Milling Machine Company

PROFILE GRINDER



Grinds concave and convex milling cutters 12 in. diameter, 3 in. radius, cutters for fluting drills, cutters that are irregular but having a number of true curves, accurately rounding the corners on side mills, face mills, and end mills, formed tools for screw machines and corner rounding

tools for the lathe, planer and shaper.

This machine spindle is driven by a Dumore Type D Universal motor, runs on any current. Ten feet of wire with lamp socket and all necessary equipment furnished.

By acting quick you can have immediate delivery.

The Cleveland
18511 Euclid Ave.



Milling Machine Co.
Cleveland, Ohio

UNIVERSAL GEAR HOBBER

The machine which completes our lines to cut all types of small gears except internal, within 10" dia. 8 Pitch.

The Bilton Gear Hobber will cut spur spiral gears, worm gears, also various special shapes of teeth. It can cut a spiral tooth on end of a shaft $1\frac{3}{8}$ " dia. 24" long.

SPECIFICATION

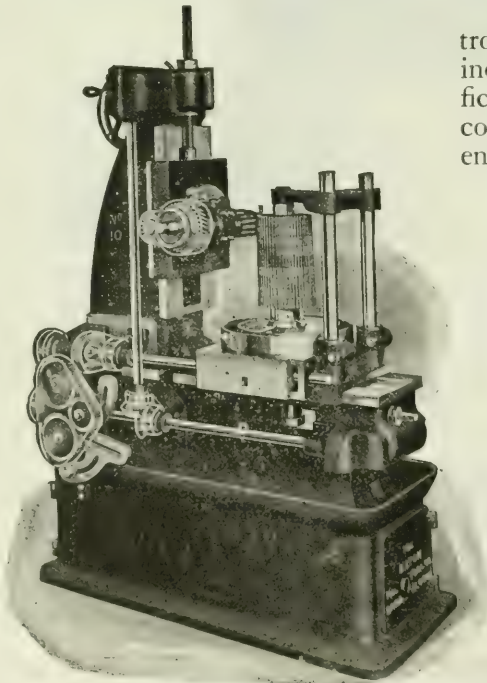
Capacity Gears: 10 Diametral Pitch
10 in. Outside Diameter
10 Width of Face

Range of hob feed 50-250 R. P. M.

Range hob feed to each rev. of worm .010 to .125

Drive: 3 Steps Cone Pulley; $2\frac{1}{2}$ in. Belt

Weight 1,100 lbs.



A machine of latest design, introducing new features which increase production without sacrificing accuracy. The hob is cutting continuously; operation of machine entirely automatic.

DELIVERY

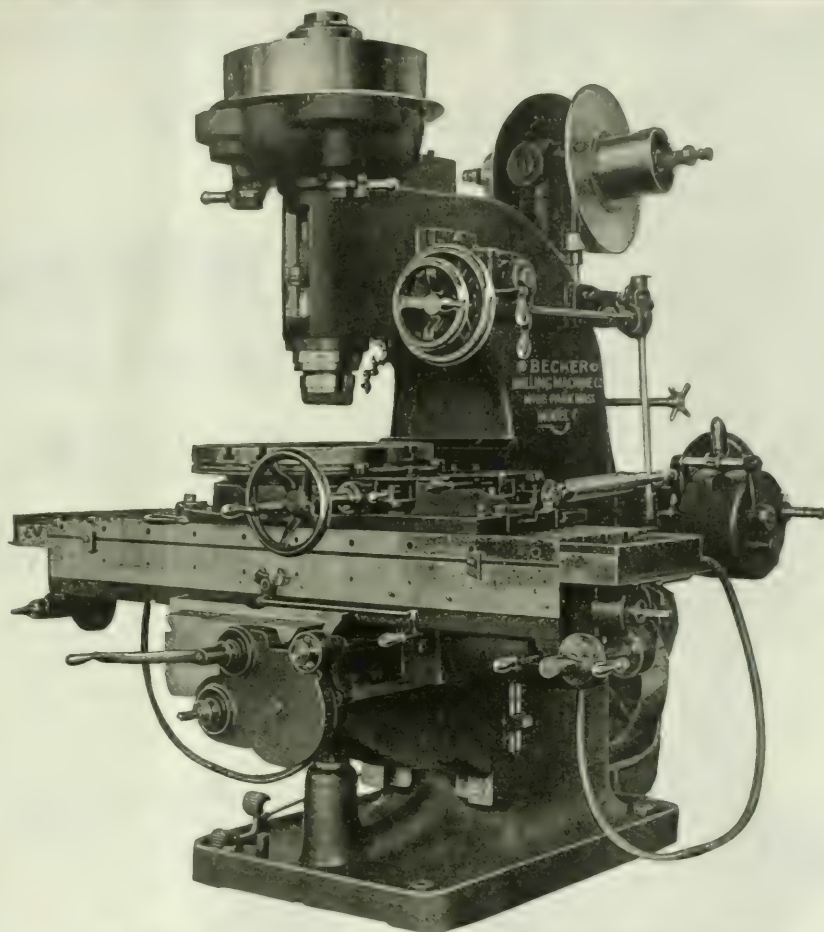
A few of these machines are now available for September delivery.

Send for copy of new catalog No. 30, and bulletin describing this machine.

THE
Bilton Machine Tool
COMPANY
BRIDGEPORT - CONN.

Foreign Agents:

ALFRED HERBERT LTD.
M. METT ENGINEERING CO.
CHAS. CHURCHILL & CO.



The demand for greater production was met and surpassed by the Becker High Power Vertical Milling Machine, and by virtue of the distinct features it possesses its superiority over other mills is very pronounced.

The fourteen types and twenty-four sizes from which to choose is

one evidence of efficiency. The individual features evident from the illustration are but an inkling of the features constructed in the machines that have gone to stamp the Becker as superior.

Your inquiry is sure of prompt, prompt and satisfactory attention.

Becker Milling Machine Company

HYDE PARK, BOSTON, MASS., U.S.A.

Agents:

THE A. R. WILLIAMS MACHINERY COMPANY CO., LIMITED

Toronto and Hamilton

Williams & Wilson, Ltd., Montreal, Que.

If any advertisement interests you, tear it out now and place with letters to be answered.

The **FOX** Milling Machine For Intense Production



FOX
MILLING
MACHINES
lead the field

**Power Feed
Miller No. 3**

The Fox Milling Machines are ideal, as they are particularly adapted for just that sort of work.

Every machine is provided with micrometer dials on the vertical and transverse movements, thus insuring accuracy in every detail.

Write for full particulars.

FOX MACHINE COMPANY
1047 W. Ganson Street, Jackson, Michigan

KEMPSMITH

UNIVERSAL MILLING MACHINES

Every Kemp Smith Milling Machine of whatever size is provided with a suited spindle nose for positive drive of arbor and for positive drive of face milling cutter in either direction.

Every machine is equipped with our patented keyed overhanging arm which insures positive alignment of arbor and boring bar and also prevents the cutter being pounded out of line under cut.

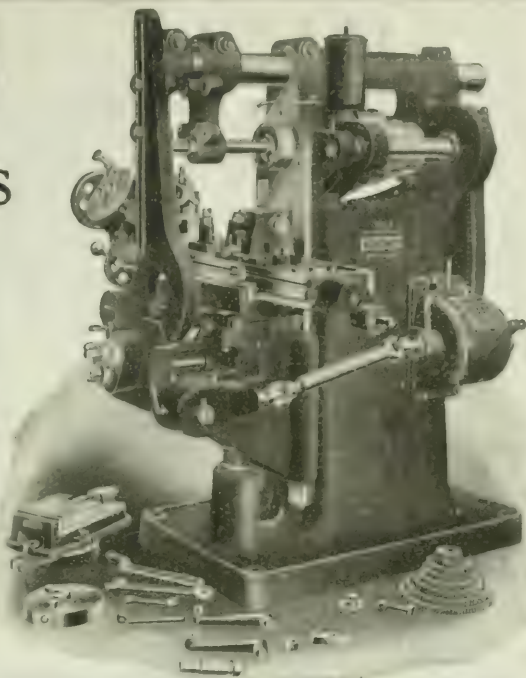
Kemp Smith machines are heavy, with weight well distributed and their accuracy is guaranteed within very close limits.

See Eye Illustration Catalogue.

Kemp Smith Manufacturing Co.
MILWAUKEE, WIS., U.S.A.

AGENTS:

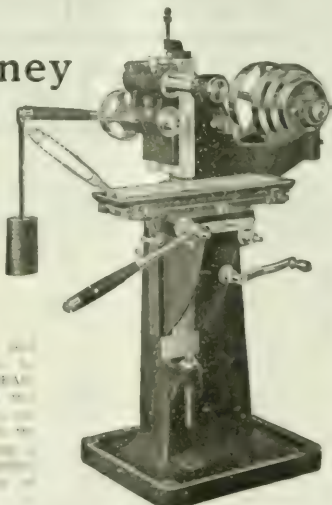
Foss & Hill Machinery Co., Montreal.
General Supply Company, Toronto and Ottawa.
Canadian Western Foundry & Supply Co., Calgary, Alta.



THOUSANDS IN USE

The Whitney

Hand
(Feed)
Milling
Machine



The Whitney Hand Milling Machine is the standard machine for the tool room of every machine shop. It is the only machine of its kind that can be used for both rough and finish work. The Whitney Hand Milling Machine is the only machine of its kind that can be used for both rough and finish work.

Send for Catalogue A

The Whitney Mfg. Co.
Hartford Conn. U.S.A.

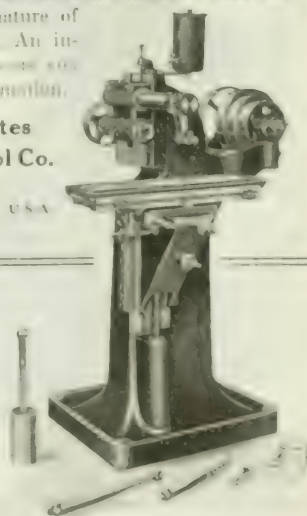
Chains—Keys—Hand Milling Machines.

No. 1 U.S. Milling Machine

Built to take care of the work that it would not pay to put in a larger machine. You would be astonished at the range of work and the compact nature of this machine. An inquiry would secure you complete information.

**United States
Machine Tool Co.**

Cincinnati Ohio U.S.A.



If any advertisement interests you, put it out now and place with letters to the editor.

HALL

Pipe Threading Machinery AND Shell Cutting-off Machines

This illustration shows the new No. 8 Hall Gear Box Driven Pipe Lathe. Regular Capacity 2½" to 8" inclusive.

The last word in Pipe Machine Construction

Let us give you full particulars of this machine which is only one of a large number having capacity ⅛" to 18" pipe.

Write us for catalog and prices on:

Pipe Threading Machines Nipple Threading Machines
Roller Pipe Cutters

or

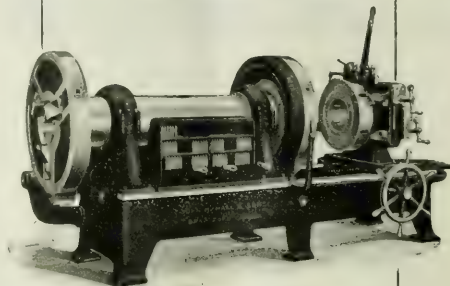
Cutting-off Machine for shells or bar stock.
Any capacity ⅛" to 18".

John H. Hall & Sons, Ltd.
BRANTFORD, CANADA

EUROPEAN AGENTS:

Universal Machinery Corporation, Limited, London

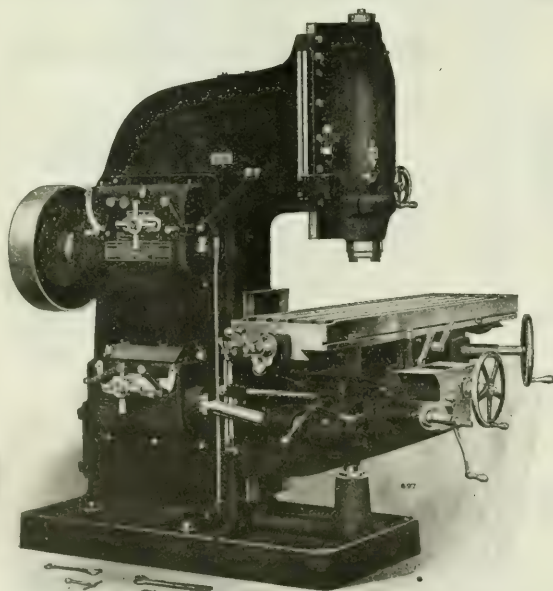
*Made in
Canada*



Capacity

2½" to 8"

inclusive



CINCINNATI VERTICALS

UNUSUAL SPINDLE POWER. HEAT TREATED ALLOY STEEL HARDENED GEARING.

MASSIVE SPINDLE HEAD CONSTRUCTION.

HANDY - CAN MILL AROUND A RECTANGLE WITHOUT STOPPING FEED OR SPEED.

These are some reasons why you should use CINCINNATI VERTICALS.

The Cincinnati Milling Machine Company
CINCINNATI, OHIO.

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H. W. Petrie, of Montreal, Ltd.
Taylor Engineering Co., Ltd.
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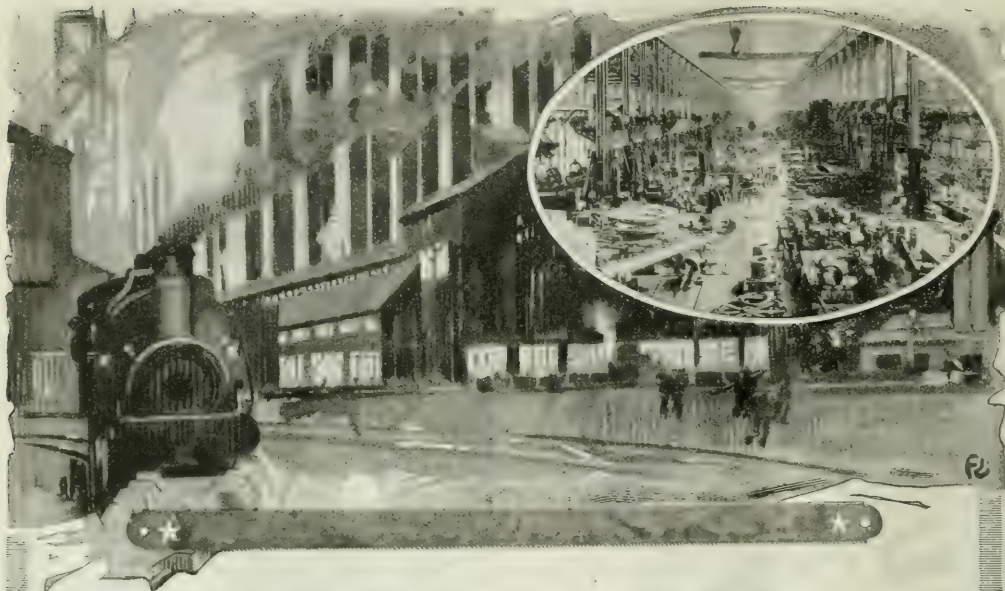
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**THE SUN
NEVER SETS
ON
QUALITY SAWS**

**EVERY TOOTH CUTS
ON
EVERY QUALITY SAW**
THEY CUT STRAIGHTER AND LAST LONGER
Canadian Representative:
F. Bacon & Company, Montreal, Canada

NAPIER SAW WORKS Inc.
SPRINGFIELD, MASSACHUSETTS U.S.A.

If any advertisement interests you, tear it out now and place with letters to be answered.



BETHLEHEM CUTS STEEL WITH FASTEST CUTTING HACK SAWS

THAT the Bethlehem Steel Co., uses STAR BLADES is vitally significant for every manufacturer who saws metal. Because every tool the famous Bethlehem plant uses has first had to prove beyond question its ability to help extend their output to the last notch.

You who are buying hack saw blades to-day—whether machine or hand blades—must realize that in last analysis you are not buying blades at all but the output those blades will give you. It is not a question of getting blades at the lowest cost but of getting blades that will give you the maximum number of cuts at the lowest cost.

STAR HACK SAW BLADES

Machine and Hand

were the first modern blades ever manufactured and for thirty years they have held their quality supremacy. Hundreds of thousands of tests have been made to determine out of thousands of combinations exactly what relative dimensions, what shape and setting of teeth and what kind and hardness of steel would give the best cutting results.

Our special automatic machinery with its gauges to the finest limits, makes possible a uniform quality of production that ordinary methods could not give and an unbelievable quantity production at a minimum of factory cost. It is significant that the pre-

Flexible and All Hard

sent standard practice with other hack saw makers was abandoned by us more than twenty years ago for more efficient methods.

The Star line includes machine and hand blades—flexible and all hard for every purpose. Whatever your metal sawing problem, there is a Star Blade that will give you the greatest cutting efficiency at the smallest blade and time cost.

Prove this fact for yourself by making the most drastic tests or place the burden of proof on us and we will demonstrate the greater efficiency in Star Blades to your thorough satisfaction. The more difficult the problem, the more we will welcome the chance to show you.

Address our Engineering Department at 200 River Street, Millers Falls.

\$500.00 FOR YOUR EXPERIENCE

Our position as authorities on metal sawing efficiency has made us a national clearing house of information on the results blade users are getting under all classes and kinds of conditions. To encourage this clearing house idea, we offer \$500.00 in gold for the best articles on "How I Test Hack Saws." Tell us your methods in detail either on machine or hand blades and give us your conclusions with

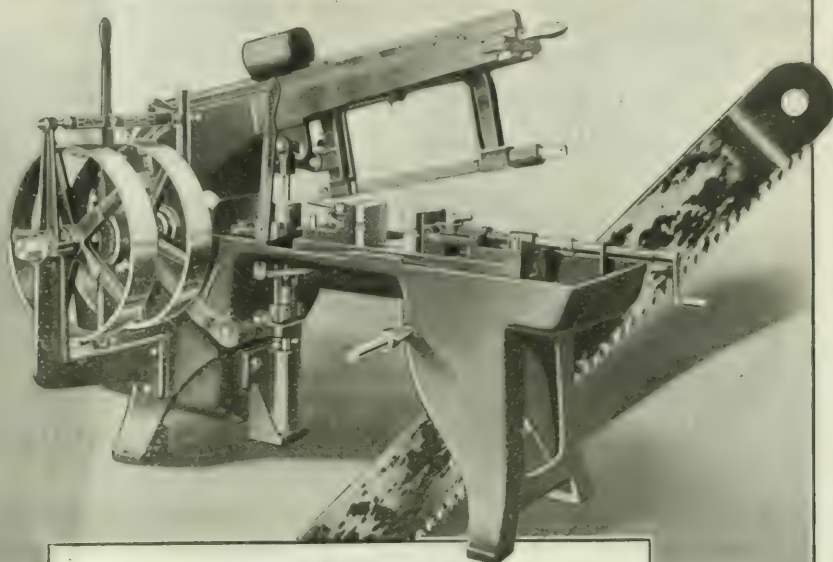
1st Prize	- - - - -	\$250.00
2nd Prize	- - - - -	100.00
3rd Prize	- - - - -	50.00

absolute truth and frankness, including some of the records of your results. It is not necessary to be a Star user to win a place in this prize award. We want your experience whatever it is. Get your reply in as early as possible. The best replies will be published in book form and in our advertising. CONTEST CLOSES NOVEMBER 30.

4th Prize	- - - - -	\$25.00
5th Prize	- - - - -	15.00
6th to 11th Prizes	- - - - -	\$10.00 each

Manufactured by CLEMSON BROS., Middletown, New York
MILLERS FALLS COMPANY, Millers Falls, Mass. Sole Distributors

An Unbeatable Combination



An Unbeatable Combination

Are you a manufacturer of metal products, where accuracy, speed, production and economy count, and which require constant cutting-off of stock.

Here's The Combination You Are
Looking For

The V. S. W. No. 5 High Speed Hack Saw Machine equipped with a VICTOR blade is unbeatable when it comes to increased production, and a minimum amount of power blade breakage and consumption

Why?

An actual machine and blade operated by one of your own men in your own shop will be the most convincing demonstration we can make

Let us send you one V. S. W. machine on a thirty days' trial, with enough VICTOR blades to show you why.

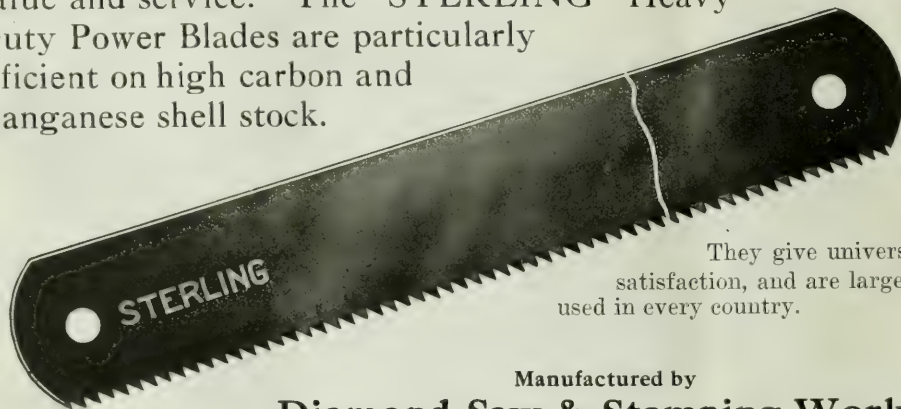
VICTOR SAW WORKS LTD - HAMILTON, CANADA



If any advertisement interests you, tear it out now and place with letters to be answered.

"S-T-E-R-L-I-N-G"

This brand on a HACK SAW BLADE spells good value and service. The "STERLING" Heavy Duty Power Blades are particularly efficient on high carbon and manganese shell stock.



They give universal satisfaction, and are largely used in every country.

Manufactured by
Diamond Saw & Stamping Works
Buffalo, N.Y., U.S.A.

THE IMPROVED TAYLOR-NEWBOLD



INSERTED TOOTH COLD SAW
WRITE FOR BULLETIN T-5
Tabor Mfg. Co. Philadelphia, U.S.A.

Tel. Main 6755

Jos. Bickerstaff, Mgr.

THE ELM CUTTING OIL COMPANY

TORONTO

Cutting and Drawing Oils
a Specialty

Best for Thread Cutting
and Tapping

Our Cutting Oils especially adapted for Automatic Machines, Turret Lathes and Thread Millers.

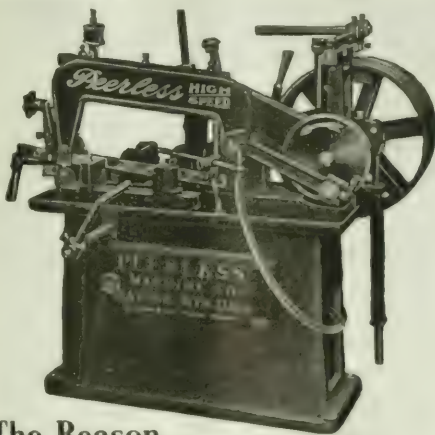
PRICES ON APPLICATION



The severe tests of shell work, the speed and efficiency required by this kind of work has only added more fame to the already popular Racine. The lack of all superfluous mechanisms. The speed. The clearest, positive action of the blade. These all go to make the Racine the machine it is.

An inquiry would secure
you all information.

Racine Tool & Machine Company
15 Melbourne Ave., Racine, Wis., U.S.A.



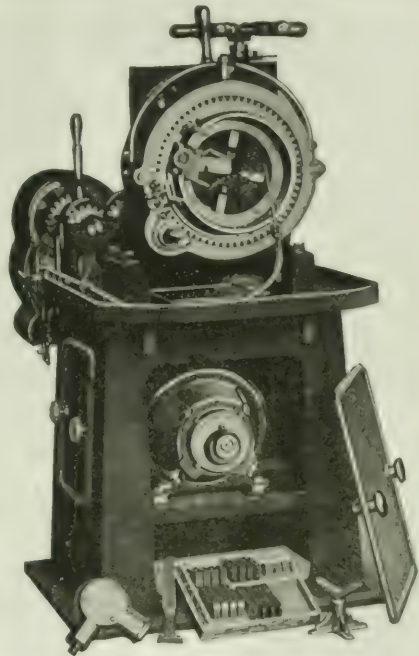
The Reason For So Many Repeat Orders

after comparing them to most of the other machines in the market for
lathe work, the Peerless machine is found to be the best of all.

A Peerless machine will save you money in the long run. It is the only machine in the
United States that will cut a true thread in half the time of any other machine.

One of the best reasons for buying a Peerless machine is that it will save you
time and money in the long run. It is the only machine in the United States
that will cut a true thread in half the time of any other machine.

PEERLESS MACHINE CO. 1607 Racine St.
RACINE, WIS., U.S.A.



"Forbes Facts"

1. One man can do the work of six against the old stock and die method of cutting.
2. It is the only machine on the market with receding gear.
3. It is self-contained and motor-driven.
4. It is portable.

These are convincing arguments for the construction and utility of this machine. Thread cutting can be performed fast, clean and true. Equipped with self-centering vise.

The Curtis & Curtis Co.
115 Garden St. Bridgeport, Conn.

If any advertisement interests you, tear it out now and place with letters to be answered.

CARBORUNDUM AND ALOXITE DISCS

JUST as soon as you begin using *Carborundum and Aloxite Discs*, your disc grinder becomes a more efficient and a more profitable machine. **E**very disc is fast cutting, uniformly coated, long lived. Every disc cuts free and clean without filling—*And the Grain Stays on.*

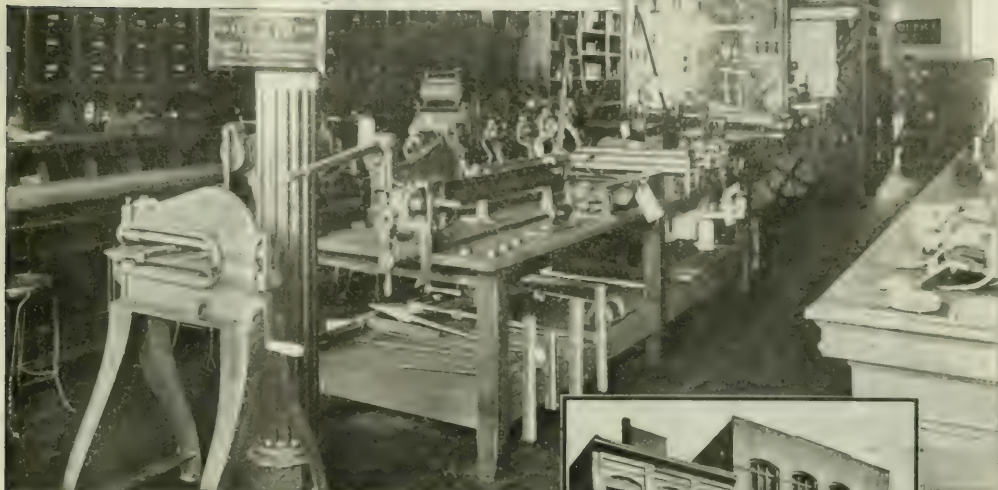
Made in all sizes and grits.
Samples upon request
any time.



THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.

NEW YORK CHICAGO PHILADELPHIA CLEVELAND CINCINNATI BOSTON PITTSBURGH
MILWAUKEE GRAND RAPIDS

PEXTO TRAVELS MONTREAL



WILLIAMS & WILSON, LTD., of Montreal, hold Pexto Sheet Metal Workers' Machines and Tools in such high regard that the Pexto Display pictured above, is a permanent feature with them.

It is indeed significant when such a well established house expresses its approval of a product in this substantial way. There is no better evidence of Pexto Quality.

You'll find much of practical value in this display. Pexto Sheet Metal Machines and Tools embody many important improvements. They record the rapid advancement made in the Sheet Metal Trades during the past few years. They have more than kept pace.

The great need of trained mechanics in the Sheet Metal Industry gives added importance to Manual Training and Vocational Education. School Officials and School Shop Instructors will appreciate the practical assistance Williams & Wilson, Ltd., can give in the selection of proper school equipment.

Send for the Pexto Pocket Manual. It tells about the new ideas in sheet-metal working machines and contains other valuable information. Free.

PEXTO

SHEET METAL WORKERS' MACHINES & TOOLS



The Home of Williams & Wilson, Limited,
and the Pexto Display.

The Peck, Stow & Wilcox Company

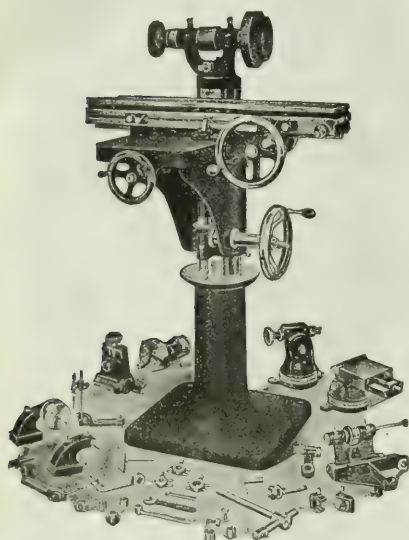
Mills' Measuring' Hand Tools, Pneumatics,
and Sheet Metal Working Tools and
Machines, Hangers and General Hardware.

Southington, Conn.

Cleveland, Ohio



The *Greenfield* For General Tool Room Work



This Grinder is furnished with attachments for grinding all kinds of milling cutters, reamers, counterbores, and other machine shop tools.

It is also suitable for cylindrical, internal and flat work which frequently turns up in the making of tools and jigs.

These attachments are all very simple in design and easily adjusted upon the machine, being graduated so that any desired angle can be at once obtained.

The whole machine is thoroughly well built, well finished and will be found a dependable, convenient grinder.

Greenfield Machine Company
GREENFIELD, MASS., U.S.A.

WHY TOLERATE

TROUBLE

in YOUR Grinding Department?

Eliminate all difficulties by using High-Grade Selected

DIAMONDS

Direct from the South African Diamond Fields. All sizes at your command, either unmounted or mounted in any style holder, **MADE IN CANADA.**

Try our **CAST STEEL** mounting for complete satisfaction of performance.

Wheel Trueing Tool Company

88 West Pitt Street

WINDSOR, ONTARIO

Mention this paper when writing advertisers. It will identify the proposition about which you require information.



Sturtevant

Trade Mark

Individual Heater Units for Shop Heating

Illustration shows small self-contained heating unit with turbine-driven disc fan. These units diffuse large volumes of warm air along the floor, and are ideal for heating shops, roundhouses, industrial buildings, pump-houses or oil-houses.

Advantages :

Inexpensive—Self-contained—Require only one steam pipe
—Exhaust steam from turbine used in coils—Can be moved by crane or truck to other location or plant—Can be readily sold—Belt-drive or motor-drive is readily possible.

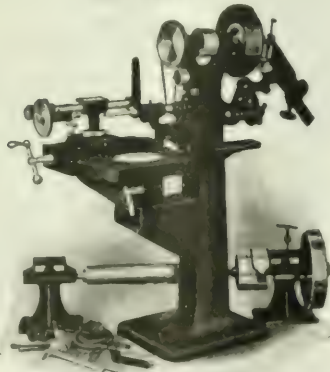
Full information on request.

B. F. Sturtevant Company of Canada, Limited
GALT, ONTARIO

Montreal Toronto

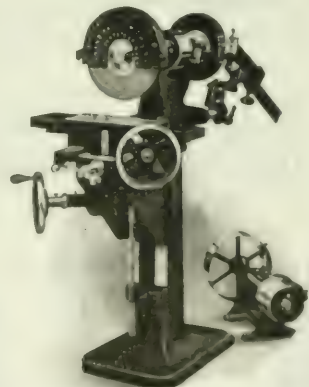
Winnipeg Vancouver

W & M Cutter---Reamer---Drill Grinder



When Accuracy and Convenience are Essential
Wilmarth & Morman Grinders Are Installed

W & M No. 1 Surface Grinder



When Rapidity and Rigidity Are Desired
Wilmarth & Morman Grinders Meet Requirements

WILMARTH & MORMAN COMPANY

Manufacturers of Drill Grinders—Surface Grinders—Universal Grinders

1200 Monroe Ave., N. W., GRAND RAPIDS, MICHIGAN, U.S.A.

If any advertisement interests you, tear it out now and place with letters to be answered.

The "Feel" of a Good File

Did you ever watch a really capable mechanic test a file? He has a way of passing a sensitive thumb over its teeth. Instinctively, unfailingly, he thereby determines whether it is fit for use.

This man always chooses "FAMOUS FIVE." He never buys blindly. He can "feel" that a "FAMOUS FIVE" is right. He can "feel" its sharp, keen-cutting teeth, arranged in rows of perfect uniformity. There is no doubt in his mind. He buys "FAMOUS FIVE." He makes sure of satisfaction.

Our catalogue and copy of "File Philosophy" will interest you. Write for them to-day.



Mention this paper when writing advertisers. It will identify the proposition about which you require information.

Stow Shell Grinders Increase Production



**Suspended
Pedestal
Mounted
on Truck**

**Any Size
Any Current**

**Immediate
Shipment**

Stow Manufacturing Co.

Binghamton, New York, U.S.A.

Oldest Portable Tool Manufacturers in America

Assuming that you want a grinder that is better than the average—

A grinder with massive table, micrometer adjustments, very long knee and gibs, and extra heavy head and tailstock—it will pay you to investigate the

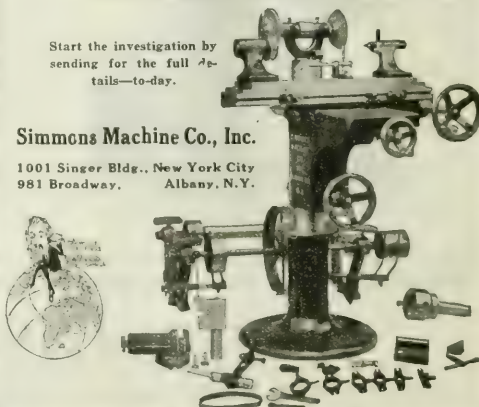
**Standard No. 6
Universal Grinding Machine**

In addition, you'll find that the headstock is fitted with large bearing for chuck spindle and with special bronze bearings of navy specifications, spindle is tapered and bored to take wheel arbors, and bearings are 1 in. in diam. and 2½ in. long, and an exceptionally simple and sturdy countershaft with self-lubricating bearings.

Start the investigation by sending for the full details—to-day.

Simmons Machine Co., Inc.

1001 Singer Bldg., New York City
981 Broadway, Albany, N.Y.





WE BUILD THEM BY HUNDREDS

Standardized Production enables us to offer this powerful **Waterbury Grinder** at such a low price. It grinds rapidly and accurately, on flat surfaces, dies, punches, planer, lathe, and other tools. Has adjustable table and tool rest, with large radius of travel. Rigid, 3-point table supports giving great steadiness. A reliable, practical grinding outfit.

only \$75 Complete

The Blake & Johnson Co., Waterbury, Conn.

Grinding Wheel Dressers

We are specialists in Grinding Wheel Dressers and can recommend the best types for any particular needs.

Our Dressers are:

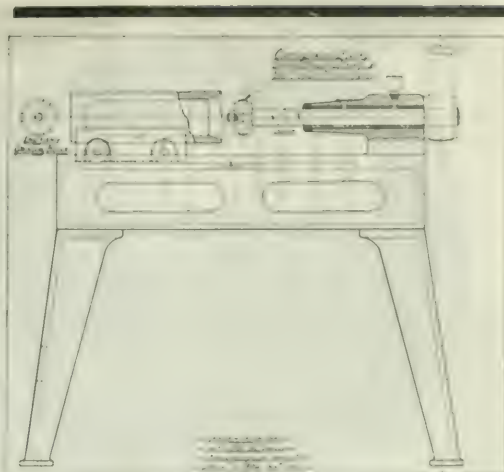
Diamo-Carbo
Desmond Huntington, 3 sizes
Sherman Corrugated, 2 sizes
Norton Zig-Zag, 2 sizes
Magazine Diamonds

We can promptly supply your needs from our stock.

The
Canadian Desmond-Stephan
Manufacturing Company
HAMILTON, ONTARIO

Alfred Herbert, Ltd., Coventry, Eng.
 Agent for Great Britain

If any advertisement interests you, tear it out now and bring with letters to be answered.



Smooth Bores

We have designed for our own use a simple and inexpensive grinder to give the final touch to the bore of our shells.

It does the work, and we will have some of these machines on the market shortly.

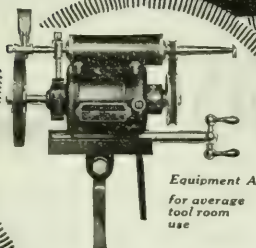
Write us for our proposition.

Marsh & Henthorn
Limited

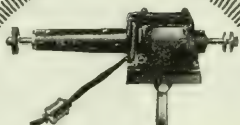
BELLEVILLE, ONTARIO

DUMORE

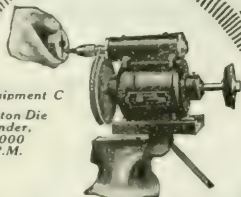
PORTABLE ELECTRIC GRINDERS



Equipment A
for average
tool room
use



Equipment B
for deep, internal work



Equipment C
Button Die
Grinder,
50,000
R.P.M.

In grinding tools, gauges and dies, there's a big unsolved problem in your shop—unless you use DUMORE Portable Grinders. Thousands of them are in use on various kinds of grinding jobs where extreme accuracy is required. Dynamically balanced armatures mean increased speed, freedom from taper or bell mouth and the elimination of chatter marks.

Three types of equipment. Equipment A, includes 3" internal spindle, 30,000 R.P.M.; Motor spindle, 10,000 R.P.M. Equipment B has Extension Arm B, with 10" reach, speed 10,000 R.P.M. Equipment C has special spindle and chuck, speed 50,000 R.P.M.

Each outfit comes packed in a substantial hardwood case—can be easily carried from one part of the shop to another. This cut shows Equipment A. All types are completely equipped and furnished with well-known DUMORE Universal Motor, operating equally well on direct and alternating current.

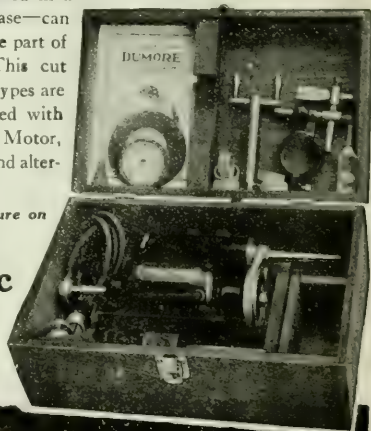
Write today for illustrated literature on type of equipment you need.

**Wisconsin Electric
Company**

1713 Dumore Bldg.

Racine

Wis.





Gardner Grinders

**GRINDING BASE
OF 18-pr. SHELL**

This No. 14 Double Disc Grinder is used for accurately sizing the bases of these shells after heat treating. The shell is held in a suitable fixture, which allows it to be revolved slowly between the discs which grind the diameter to within 3.28 and 3.29 inches.

The quality and finish of the work is perfect, and steady production can be maintained at an average rate of 5 per minute.

The discs are faced with abrasive at the outer part only, where the work is done.

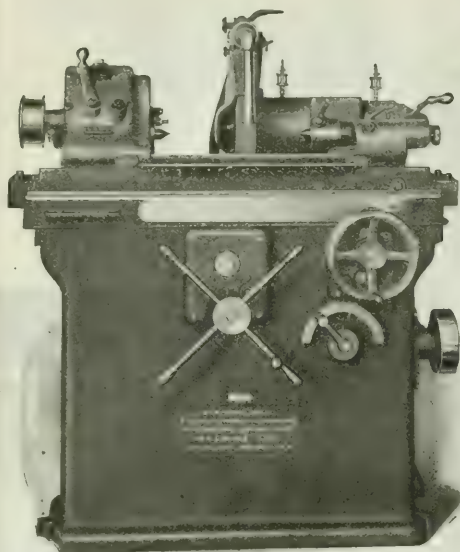
All that is best in material and workmanship goes into Gardner Grinders. They last long, do the work as it should be done, and do it economically.

Drop a card for full particulars.

The Gardner Machine Company, Beloit, Wis., U.S.A.

Canadian Sales Agents: THE CANADIAN FAIRBANKS-MORSE COMPANY, LIMITED
St. John, Quebec, Montreal, Ottawa, Toronto, Hamilton, Windsor, Winnipeg, Saskatoon, Calgary, Vancouver, Victoria

If any advertisement interests you, tear it out now and place with letters to be answered



Fitchburg Grinders

Model "A" illustrated here is a machine whose chief feature is its capacity for size, variety and quality of work. Its speed will give you greater production; its size, convenience, increased production, strength and saving in floor space will effect such a saving as to make it preferable over all other machines of similar character.

It is specially adapted for grinding straight or taper shafts.

An inquiry would speedily get you valuable information and data.

Fitchburg Grinding Machine
COMPANY

Fitchburg,

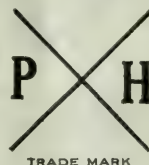
Mass.

U.S.A.

The "FEEL" of a Tool

Every good mechanic knows what the "Feel" of a tool is. The poise, and the balance, the weight, and the shape—all go to make up that elusive Quality.

EACH



TRADE MARK

QUALITY FILE

is made specially for the job for which it is intended. It has that "Feel" which good mechanics know everywhere as the sign-mark of a Fine Tool.

P. H. FILES CUT—AND THEY WEAR.

Port Hope File Mfg. Co., Ltd.
Port Hope, Ont.

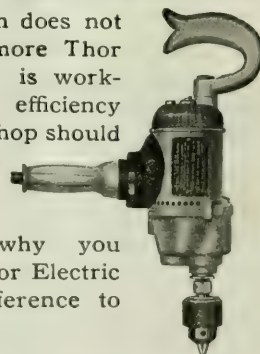
"ASK YOUR JOBBER"

Thor

UNIVERSAL Electric Drills

Licensed Under Burke
Universal Motor Patent

No shop which does not use one or more Thor Electric Drills is working to full efficiency which every shop should do during these critical times. Let us demonstrate why you should use Thor Electric Tools in preference to other makes.



Independent Pneumatic Tool Company

Office: 334 St. James Street, MONTREAL, QUE.
Toronto: 32 Front St. W. Winnipeg: 123 Bannatyne Ave., E.
Vancouver: 1142 Homer Street

CLEVELAND SAND RAMMERS

FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

Cleveland Sand Rammers are made in several sizes and weights, and are adapted for all kinds of Ramming in general foundry service.

The Piston Rods are packed with a resilient packing that conforms to the shape of Rod without retarding its free action, and prevents any dirt from entering piston chamber and working parts. Rammers are fitted with either Round or Flat Rods as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.



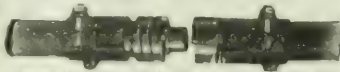
CLEVELAND CHIPPING HAMMERS

For General Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are particularly adapted for fast chipping now required by piece-work operators.

BOWES AIR HOSE COUPLINGS

Over 1,000,000, in General Use

Bowes Couplings are instantly connected or disconnected.



Bowes Couplings are absolutely air tight under all pressures.

Also on stock the Never Slip Coupling and the Bowes Coupling. In Stock: RIVETING HAMMERS, DRILLS, REAMING, TAPPING AND FILE-ROLLING MACHINES, CORNER DRILLS, PORTABLE AND BENCH GRINDERS, ETC.

Catalog No. 12 mailed on request.

ADDRESS ALL INQUIRIES TO

CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED
84 CHESTNUT STREET, TORONTO, ONT.

Agents: A. R. WILLIAMS MACHINERY CO., TORONTO

WILLIAMS & WILSON, MONTREAL

Sand Rammer in operation.



OBTAIN THE BEST RESULTS

From Cutters and Tools Kept Sharp on
GARVIN No. 3 UNIVERSAL
CUTTER AND SURFACE GRINDERS

Simple Light Running Accurate

The spindle is hardened and ground and supported on roller to the wheel by an extended bearing, and completely protected from injury.

The knee and the yoke carried on the knee both have a large range of adjustment. On the knee yoke or carriage is mounted the swiveling table, which has a quick, sensitive movement by rack and pinion operated from end or side.

On this table is mounted the index head, and all the attachments are held in this head.

A complete range of accessories including grinding wheels, etc., is supplied with the machine.

Machine is designed to keep its original factory accuracy.

CAPACITY: CUTTERS, 14 in. x 6 in. SURFACES, 9 in. x 6 in.

For Further Information ASK YOUR DEALER
or WRITE US DIRECT

IMMEDIATE DELIVERIES

Send for Complete Catalog

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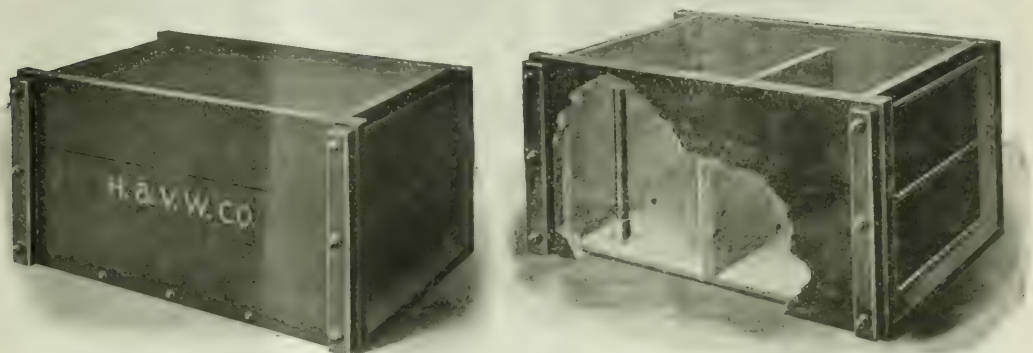
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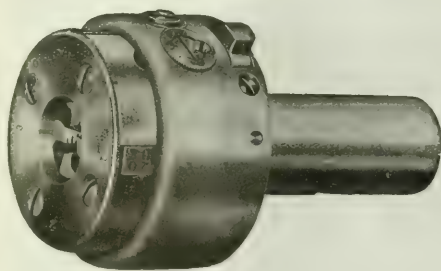
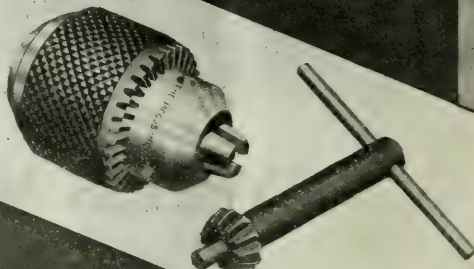
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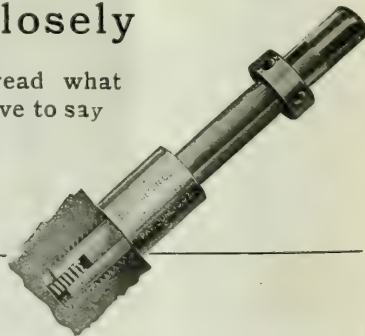
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The chasers are set and held in place by a cam. That cam once adjusted, locks; there is no stopping or changing in size. This H. & G. Automatic Self-Opening Die Head has a quick release that not only issues the cutting of the thread to a given point every time, but permits cutting right up to a shoulder when required. Our booklet will tell you more. Write for it.

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and read what
we have to say
below



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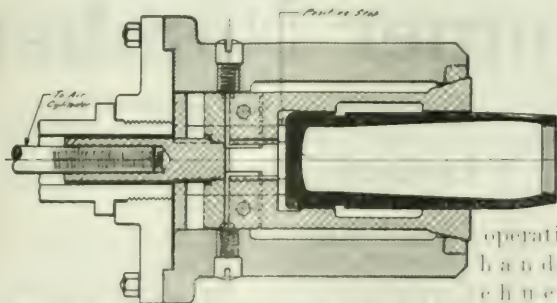
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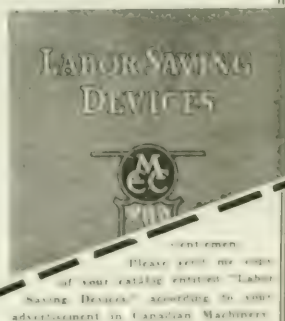
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Col. MacLean was in Germany When War Broke Out

HOW he got out, what he saw, heard, learned and concluded, he tells in the August number of **MACLEAN'S MAGAZINE**. Colonel MacLean knows Europe thoroughly. He knows high-up men in all the great political and commercial capitals of Europe—diplomats, bankers and great merchants. These men told him freely and plainly many startling things about Germany and her intentions.

In a contribution of truly sensational interest, abounding in most startling facts, Colonel MacLean points out "The Dangers Ahead." His aim is to arouse Canadians out of their unwarranted confidence and out of their content. You will

find in this article by Colonel MacLean strange, even shocking revelations, and things hard to believe—and you ought to read "The Dangers Ahead" in order that you may help in their avoidance by Canada and her people.

MacLean's for August Is a Midsummer Number

The August **MACLEAN'S** is excellently balanced, as you will see from these contents:

CONTENTS

The Dangers Ahead. By John Bayne MacLean.
The Menace of Canadian Titles. By Joseph Martin, M.P.P.
Rev. C. A. Eaton—A Canadian Who Speaks Out. By Beatrice Redpath.
Frenzied Fiction for the Dog Days—(Done by the Dipperful.) By Stephen Leacock.
The Human Side of Conscription. By H. F. Gadsby.
Winning the War in the Air. By Agnes C. Laut.
A Circus Story. By L. B. Yates.
Mam'selle Butterfly. By Arthur Beverly Baxter.
The Captain of the Susan Drew. By Jack London.
An Andy Doolin Yarn. By Hopkins Moorhouse.
A Detective Story. By Robert E. Pinkerton.
The Gun Brand. By Jas. B. Hendryx.
Canada's First Woman Member.
Economy in Preserving and Canning.
Women and Their Work—A New Department. Review of Reviews—Regular Department.

Yates who writes the Circus Story, was born in Hamilton. He wrote those stories about Paragon Pete and The Singin' Kid in the *Saturday Evening Post*.

Leacock is excessively humorous in his Dog Days Sketch, in which he talks about summering and simmering.

Miss Laut fancies that the war may be won by the birdmen, and if Uncle Sam produces 100,000 planes, she may be right.

Gadsby sits in the Press Gallery at Ottawa, and writes brilliantly always. His "Conscription" article is in order.

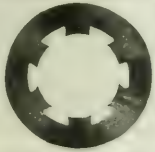
Pinkerton who writes the detective story, "Old Twilight," knows how to write this class of story.

By the way, Lord Northcliffe has promised an article for the September **MACLEAN'S**.

You can see that **MACLEAN'S** for August is just the right type for August.

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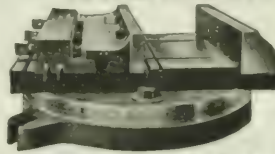
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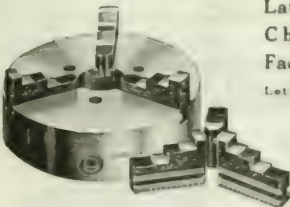
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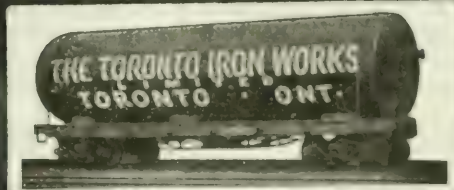
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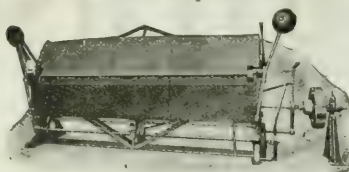
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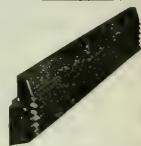
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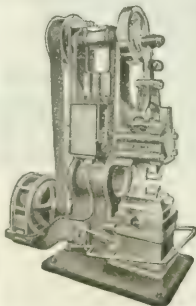
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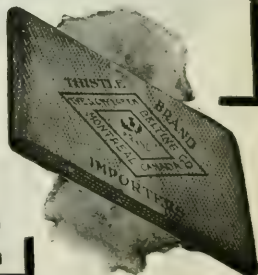
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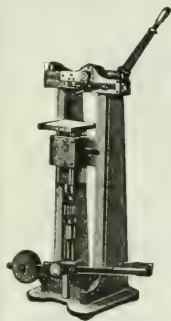
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Gardner, H. J., & Son, Montreal.
Landis Machine Co., Wayneboro, Pa.
National Machinery Co., Tiffin, O.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Riverside Machinery Depot, Detroit, Mich.
A. H. Williams Machinery Co., Toronto.

BOLTS AND NUTS, BRASS

COPPER AND BRONZE

Hungerford Brass & Copper Co., New York, N.Y.

BOLT THREADING MACHINERY

Cook, Asa S., Hartford, Conn.
Victor Tool Co., Watertown, Pa.

BORING MACHINES, PNEUMATIC CYLINDER

Cleveland Pneumatic Tool Co. of Canada, Toronto.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Can. Ingersoll-Rand Co., Sherbrooke, Que.
Garlick Walker Machinery Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

BORING MACHINES, UPRIGHT AND HORIZONTAL

John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Dominion Machinery Co., Toronto.
Garlick Walker Machinery Co., Toronto, Ont.
Niles-Rementum Co., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Riverside Machinery & Tool Co., Toronto, Ont.
Riverside Machinery Depot, Detroit, Mich.
Stow Mfg. Co., Binghamton, N.Y.

BORING MACHINES, STOVE AND COAL

Cunningham & Son, J. W., New Glasgow, Canada.

BORING AND TURNING MILLS

John Bertram & Sons Co., Dundas.
Canada Machinery Corp., Galt, Ont.
Foss & Hill Machy. Co., Montreal.
Niles-Rementum Co., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.

BOXES, STEEL SHOP AND TOTE

Cleveland Wire Spring Co., Cleveland.
New Britain Mach. Co., New Britain, Conn.

BRACKS

Bentons Limited, Pittsburgh, Pa.
Steel Building Brack Works, Ltd., Chatham, Ont.

BRASS AND COPPER BRASS, ROIDS AND SHEETS

Hungerford Brass & Copper Co., New York.
Hungerford Brass & Copper Co., New York.

BRASS WORKING MACHINERY

Garlick Walker Machinery Co., Toronto, Ont.
Garlick, Holt & Co., Toronto, Ont.
Garlick Walker Machinery Co., Toronto, Ont.
Widener Co., Hartford, Conn.
Niles-Rementum Co., New York.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.

BRIDGES, RAILWAY AND HIGHWAY

The Jencks Mach. Co., Ltd., Sherbrooke, Que.
MacKinnon, Holmes Co., Sherbrooke, Que.

BRONZE ROIDS AND SHEETS

Hungerford Brass & Copper Co., New York.

BRIDGES, RAILWAY AND HIGHWAY

Hungerford Brass & Copper Co., New York.

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Hungerford Brass & Copper Co., New York.

BRIDGES, RAILWAY AND HIGHWAY

Hungerford Brass & Copper Co., New York.

BUCKETS, CLAM SHELL, CRAB, DUMP

Northern Crane Works, Ltd., Walkerville, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.
BUCKETS, ELEVATING AND HOISTING
Bundell, John J., Toronto.

BULLDOZERS

John Bertram & Sons Co., Dundas.
E. W. Bliss Co., Brookline, N.Y.
Canada Machinery Corp., Galt, Ont.

BURNERS, OIL AND NATURAL GAS

Beaure Industrial Furnace Co., Detroit, Mich.
Gray Mfg. & Mach. Co., Toronto, Ont.
Northern Crane Works, Ltd., Walkerville, Ont.
Oven Equipment & Mfg. Co., New Haven, Conn.

BURNING REAMERS

Wells Bros. Co., Galt, Ont.
Hungerford Brass & Copper Co., New York, N.Y.
Pameter & Bulloch Co., Gananoque.

BUTTERPERS

Wells Bros. Co., Galt, Ont.
CANNERS' MACHINERY
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Prest-O-Lite Co., Inc., Toronto, Ont.

CARS, INDUSTRIAL

Corbet Fdry. & Mach. Co., Ltd., Owen Sound, Ont.
Can. Blower & Forge Co., Kitchener, Can.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Cumming & Son, J. W., New Glasgow, Canada.

The Jencks Mach. Co., Ltd., Sherbrooke, Que.
Marsh & Hamilton, Belleville, Ont.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

CAR MOVERS

Dillon Mfg. Co., Oshawa, Ont.
CARTRIDGE MAKING MACHINERY
Blackall, Fred, S., Woodworth Tower, New York.

CASTINGS, ALUMINUM, BRASS

Cumming & Son, J. W., New Glasgow, Canada.
Alexander Fleck, Ltd., Ottawa.
Hungerford Brass & Copper Co., New York, N.Y.
The Jencks Mach. Co., Ltd., Sherbrooke, Que.

CASTINGS, GRAY IRON

Bernard Industrial Co., Th. A., Fortville, Que.
Brown, Boggs & Co., Ltd., Hamilton, Canada.
Can. Steel Foundries, Ltd., Montreal, Que.
Alexander Fleck, Ltd., Ottawa.

CASTINGS, MALLEABLE

Can. Steel Foundries, Ltd., Montreal, Que.
Cumming & Son, J. W., New Glasgow, Canada.
Can. Steel Foundries, Ltd., Montreal, Que.
Alexander Fleck, Ltd., Ottawa.

CASTINGS, NICKEL STEEL

Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
The Jencks Mach. Co., Ltd., Sherbrooke, Que.
Wm. Kennedy & Sons, Ltd., Owen Sound.
Pleasantville Foundry Co., Pleasantville, Que.

CASTINGS, STEEL CHROME

Can. Steel Foundries, Ltd., Montreal, Que.
Dominion Steel Foundry Co., Ltd., Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Wm. Kennedy & Sons, Ltd., Owen Sound.

CASTINGS, STEEL CHROME

Can. Steel Foundries, Ltd., Montreal, Que.
Cumming & Son, J. W., New Glasgow, Canada.
Can. Steel Foundries, Ltd., Montreal, Que.
Alexander Fleck, Ltd., Ottawa.

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CHUCKS, DRILL, AUTOMATIC

Alkhead Hardware Co., Toronto, Ont.
Alkhead Hardware Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Richmond Mfg. Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
O'Brien Chuck Co., New Britain, Conn.
Thomas Elevator Co., Chicago, Ill.
D. E. Whiston Machine Co., New London, Conn.

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Alkhead Hardware Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
Richmond Mfg. Co., Toronto, Ont.
H. W. Petrie, Ltd., Montreal.

CRANES, PORTABLE

Alkhead Hardware Co., Toronto, Ont.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.
CRIMPING, LEATHER
Griston & Knight Mfg. Co., Worcester, Mass.

CUPOLAS

Can. Blower & Forge Co., Kitchener, Ont.
Northern Crane Works, Walkerville.
H. W. Petrie, Toronto.
Sheldons, Ltd., Galt, Ont.

CUPOLA BLAST GILGES & BLOWERS

Whiting Foundry Equipment Co., Harvey, Ill.
Sheldons, Ltd., Galt, Ont.
CUTTER GRINDERS AND ATTACHMENTS
Cincinnati Milling Machine Co., Cincinnati.

CUTTER GRINDERS AND ATTACHMENTS

Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Menach Brass Mfg. Co., Toronto, Ont.
North Grinding Co., Worcester, Mass.
H. W. Petrie, Ltd., Montreal.

CUTTERS, PIPE (SEE PIPE CUTTERS)

Cleveland Pneumatic Tool Co. of Canada, Toronto.
CUTTERS, MILLING
Baker Milling Machine Co., Boston, Mass.
Canadian Fairbanks-Morse Co., Ltd., Montreal.

CUTTERS, MILLING

Cleveland Milling Mach. Co., Cleveland, Ohio.
Cleveland Twist Drill Co., Cleveland.
Dominion Mach. Co., Toronto, Ont.
Foss & Hill Machinery Co., Montreal.

CUTTERS, MILLING

Garvin Machine Co., New York.
Godard Tool Co., Chicago, Ill.
Hinson Tool Works, Chicago, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

CUTTERS, MILLING

Osborn (Canada), Ltd., Sam'l, Montreal, Que.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.

CUTTERS, MILLING

Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn.
CUTTING COMPOUND AND CUTTING OIL
Can. Economic Lubricant Co., Montreal.

CUTTING COMPOUND AND CUTTING OIL

Catapult Refining & Mfg. Co., Toronto.
Elm Cutting Oil Co., Montreal.
Racine Tool & Machine Co., Racine, Wis.
CUTTING-OFF MACHINES
Armstrong Bros. Tool Co., Chicago.

CUTTING-OFF MACHINES

John Bertram & Sons Co., Dundas.
Canadian Fairbanks-Morse Co., Ltd., Montreal.
Curris & Curris Co., Bridgeport, Conn.
Foss & Hill Machinery Co., Montreal.

CUTTING-OFF MACHINES

Garlock-Walker Machinery Co., Toronto, Ont.
Garvin Machine Co., New York.
Hurlbut, Rogers Mach. Co., South Sudbury, Mass.
John H. Hall Sons, Bradford, Ont.

CUTTING-OFF MACHINES

Wm. Kennedy & Sons, Owen Sound, Ont.
Peerless Machine Co., Racine, Wis.
H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.

CUTTING-OFF MACHINES

Prest-O-Lite Co., Inc., Toronto, Ont.
Racine Tool & Machine Co., Racine, Wis.
Standard Machy. Supplies, Ltd., Montreal, Que.
Tabor Mfg. Co., Philadelphia, Pa.

CUTTING-OFF MACHINES

CYLINDERS, AIR
Manufacturers Equip. Co., Chicago, Ill.
CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Hinchley Machine Co., Hinchley, Ill.

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS

CUTTING AND WELDING PLANTS
Prest-O-Lite Co., Inc., Toronto, Ont.
DAMPER REGULATORS
Canadian Fairbanks-Morse Co., Ltd., Montreal.

DAMPER REGULATORS

Alkhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Winnipeg Gear & Engr. Co., Winnipeg, Man.

DAMPER REGULATORS

DIAMONDS, BLACK AND ROUGH
Geo. A. Joyce Co., Ltd., New York.
DIAMOND TOOLS
Francis & Co., Hartford, Conn.

DIAMOND TOOLS

Geo. A. Joyce Co., Ltd., New York.
Wheel Tracing Tool Co., Windsor, Ont.
DIES, BRASS PRINTING, EMBOSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa.

DIES, BRASS PRINTING, EMBOSING AND LETTERING

DIES AND DIE STOCKS
Alkhead Hardware Co., Toronto, Ont.
Randall, W. H., & Son, Toronto.

DIES AND DIE STOCKS

Butterfield & Co., St. John, N.S.
Brown, Boggs Co., Hamilton, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Foss & Hill Machinery Co., Montreal.

DIES AND DIE STOCKS

Gardner, Robt., & Son, Montreal.
A. B. Jarline & Co., Hesper, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

DIES AND DIE STOCKS

H. W. Petrie, Ltd., Montreal.
H. W. Petrie, Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rickett-Shaffer Co., Erie, Pa.

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Standard Machy. Supplies, Ltd., Montreal, Que.
Wells Brothers of Canada, Galt, Ont.
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DIES, NOSING
March & Hemm, Ltd., Belleville, Ont.
DIES, PIPE-THREADING
Ideal Tool & Mfg. Co., Beaver Falls, Pa.

DIES, PIPE-THREADING

DIE SINKERS
Baker Milling Machine Co., Boston, Mass.
Cook, Asa S., Co., Hartford, Conn.

DIE SINKERS

Garvin Machine Co., New York.
H. W. Petrie, Ltd., Montreal.
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Alkhead Hardware Co., Toronto, Ont.

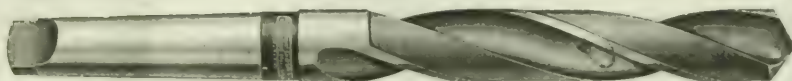
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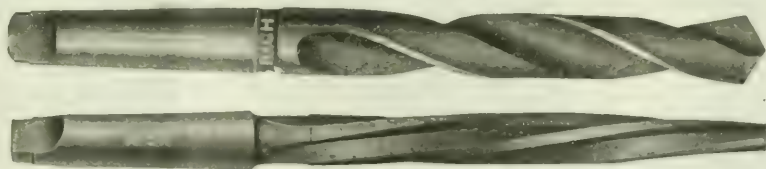
ANTICIPATION

ACCORDING TO A GENTLEMAN WHO WROTE SOME PLAYS ABOUT THREE HUNDRED YEARS AGO, IS MORE ENJOYABLE THAN REALIZATION. HOWEVER, THAT MAY BE, IT IS CERTAINLY A PAYING PROPOSITION NOW, FOR YOUR GREATEST EXPENSE IS IDLE MACHINERY.

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Your machines are probably hampered from doing their full capacity, due to the drill or reamer you are using. You keep on pulling the full power because they will hang up quickly or bind easily. With a "Rich" tool you can pull the bar to the last extremity. With a "Rich" tool you can pull the bar to the last extremity. With a "Rich" tool you can pull the bar to the last extremity.

We will solve your machine difficulty and help re-energize your plant.

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Geometric Tool Co., New Haven, Conn.

Ideal Tool & Mfg. Co., Beaver Falls, Pa.

Landis Machine Co., Waukesha, Wis.

Modern Tool Co., Erie, Pa.

Machinery & Tool Co., Detroit, Mich.

Wells Brothers Co. of Canada, Galt, Ont.

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Wells Brothers Co. of Canada, Galt, Ont.

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Brown, Rogers & Co., Hamilton, Canada.

Worth Engineering Co., Toronto, Ont.

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Graton & Knight Mfg. Co., Worcester, Mass.

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Landis Machine Co., Waukesha, Pa.

Modern Tool Co., Erie, Pa.

Machinery & Tool Co., Detroit, Mich.

National Acme Co., Cleveland, Ohio.

Wells Brothers Co. of Canada, Galt, Ont.

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W. H. Bandfield & Sons, Toronto.

Butterfield & Co., Rock Island, Que.

Can. Blower & Forge Co., Kitchener, Ont.

A. B. Jardine & Co., Hespeler, Ont.

Pratt & Whitney Co., Dundas, Ont.

Sheldons, Ltd., Galt, Ont.

DISCS, LEATHER

Graton & Knight Mfg. Co., Montreal.

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WHEEL

Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.

Ford-Smith Mach. Co., Hamilton, Ont.

DRILL HEADS, ADJUSTABLE

Two SPINDLE

Nelson-Black Mfg. Co., Detroit, Mich.

DRILL PRESSES

Aurora Tool Works, Aurora, Ind.

W. F. & John Barnes Co., Rockford, Ill.

Can. Blower & Forge Co., Kitchener, Ont.

Canada Machinery Corp., Galt, Ont.

Dominion Machy. Co., Toronto, Ont.

Foss & Hill Machy. Co., Montreal.

Garlock-Walker Machinery Co., Toronto, Ont.

Garrin Machine Co., New York.

Niles-Bement-Pond Co., New York.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

R. E. T. Pringle, Ltd., Toronto, Ont.

Riverside Machinery Depot, Detroit, Mich.

Standard Mach. & Supplies, Ltd., Montreal, Que.

United States Mach. Tool Co., Cincinnati, Ohio.

A. R. Williams Machinery Co., Toronto.

DRILLING MACHINES, BENCH

Bilton Mach. Tool Co., Bridgeport, Conn.

Martin Machine, Greenfield, Mass.

DRILLING MACHINES, GANG

Harnes, W. F. & John, Co., Rockford, Ill.

Bilton Mach. Tool Co., Bridgeport, Conn.

Canada Machinery Corp., Galt, Ont.

Salem Mfg. Co., Salem, Ohio.

DRILLING MACHINES, LOCOMOTIVE

AND MULTIPLE SPINDLE

John Bertram & Sons Co., Dundas.

Bilton Mach. Tool Co., Bridgeport, Conn.

Can. Blower & Forge Co., Kitchener, Ont.

Canada Machinery Corp., Galt, Ont.

Canadian Fairbanks-Morse Co., Montreal.

Cincinnati Pulley Machy. Co., Cincinnati, Ohio.

Dominion Machy. Co., Toronto, Ont.

Foss & Hill Machy. Co., Montreal.

Fox Machine Co., Jackson, Mich.

Garlock-Walker Machinery Co., Toronto, Ont.

Garrin Machine Co., New York.

National Acme Co., Cleveland, Ohio.

Niles-Bement-Pond Co., New York.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

Rockford Drilling Mach. Co., Rockford, Ill.

DRILLING MACHINES, JOHN AND TURRET

John Bertram & Sons Co., Dundas.

Canadian Fairbanks-Morse Co., Montreal.

Canada Machinery Corp., Galt, Ont.

Dominion Machy. Co., Toronto, Ont.

Garlock-Walker Machinery Co., Toronto, Ont.

Henry & Wright Mfg. Co., Hartford, Conn.

Niles-Bement-Pond Co., New York.

H. W. Petrie, Toronto.

DRILLING MACHINES, SENSITIVE

Aikenhead Hardware Co., Toronto, Ont.

Bilton Mach. Tool Co., Bridgeport, Conn.

W. F. & John Barnes Co., Rockford, Ill.

Canada Machinery Corp., Galt, Ont.

Canadian Fairbanks-Morse Co., Montreal.

Cincinnati Pulley Machy. Co., Cincinnati, Ohio.

Dominion Machy. Co., Toronto, Ont.

Garlock-Walker Machinery Co., Toronto, Ont.

H. W. Petrie, Toronto.

R. E. T. Pringle, Ltd., Toronto, Ont.

United States Mach. Tool Co., Cincinnati, Ohio.

A. R. Williams Machinery Co., Toronto.

Niles-Bement-Pond Co., New York.

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◆ And Now ◆
**There's An EZY-OUT Set
 for Every Shop**

YOU, who have been unable to obtain an EZY-OUT Screw Extractor Set small enough or large enough for your specialized needs, will be glad to hear that there are now

**TWO ENTIRELY NEW
 EZY-OUT Screw Extractor Sets**

TWELVE SIZES IN ALL

(Patented 1914)

Q One of the three sets illustrated on the right contains the first real solution to the broken screw problem *in your shop.*

THE MODERN METHOD

HENCEFORTH, when a screw breaks, don't waste time fussing with files and punches—just drill a hole in the broken section, insert an EZY-OUT Screw Extractor, slip on a tap wrench and twist—and out will come that screw in a fraction of the time hitherto required, and without injury to the threads.

SOONER OR LATER YOU WILL FACE AN URGENT NEED FOR THIS TOOL

Q Why wait until then and risk the delay, loss and embarrassment that this unfilled need will incur? Ask us for our booklet descriptive of these new sets and the three extra large sizes not illustrated here, or better yet, choose your set and order it from your dealer today.

The **CLEVELAND**
CLEVELAND
TWIST DRILL COMPANY

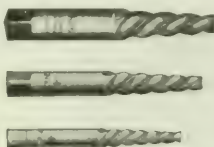
NEW YORK CLEVELAND CINCINNATI

SET NUMBER 15



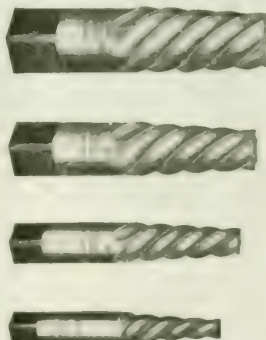
Price — \$2.25 F. O. B. Cleveland

SET NUMBER 17



Price — \$1.75 F. O. B. Cleveland

SET NUMBER 16



Price — \$4.00 F. O. B. Cleveland

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Canada Wire & Iron Goods Co., Hamilton, Ont.

FIRE EXTINGUISHERS

Strong, Kennard & Nutt Co., Cleveland, Ohio.

FIRST AID CABINETS

Strong, Kennard & Nutt Co., Cleveland, Ohio.

FISH PLATES

Can. Steel Foundries, Ltd., Montreal, Que.

FIXTURES

Monarch Brass Mfg. Co., Toronto, Ont.

FLEXIBLE SHAFTS

H. E. T. Pringle, Ltd., Toronto, Ont.

Stow Mfg. Co., Binghamton, N.Y.

FIRST SHOT

U.S. Silica Co., Chicago, Ill.

FOIGENS, HAND, PORTABLE

Aikenhead Hardware Co., Toronto, Ont.

Can. Blower & Forge Co., Kitchener, Canada.

Sheddons, Ltd., Galt, Ont.

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Bradley & Son, Inc., C. C., Syracuse, N.Y.

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AND Locomotive

Bliss, E. W. Co., Brooklyn, N.Y.

Can. Killings & Spencer, Ltd., Welland, Ont.

Cumming & Son, J. C., Glasgow, Canada.

Dom. Forge & Stng. Co., Walkerville, Ont.

Steel Co. of Canada, Ltd., Hamilton, Ont.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.

J. H. Williams & Co., Brooklyn, N.Y.

FORGING HAMMERS, BELT-DRIVEN

Bliss, E. W. Co., Brooklyn, N.Y.

J. H. Williams & Co., Brooklyn, N.Y.

FORGING HAMMERS, STEAM OR AIR

Erie Foundry Co., Erie, Pa.

FORGING MACHINERY

Hickory Steel-Grip Glove Co., Dundas.

Bliss, E. W. Co., Brooklyn, N.Y.

Brown, Boggs Co., Ltd., Hamilton, Canada.

Erie Foundry Co., Erie, Pa.

Garlock-Walker Machinery Co., Toronto, Ont.

National Machinery Co., Tiffin, Ohio.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

FUEL OIL SYSTEMS

Gilbert & Barker Mfg. Co., Springfield, Mass.

FRICITION LEATHERS

Graton & Knight Mfg. Co., Montreal.

FURNACES, ANNEALING, ETC.

Can. Hoskins, Ltd., Walkerville, Ont.

Gilbert & Barker Mfg. Co., Springfield, Mass.

Mechanical Engineering Co., Montreal.

Woodwell Co., W. S., New York, N.Y.

Tate-Jones & Co., Leetsdale, Pa.

Whitney Foundry Equipment Co., Harvey, Ill.

FURNACES, BLAST

Toronto Iron Works, Ltd., Toronto.

FURNACES, BRASS, MALLEABLE

Whitney Foundry Equipment Co., Harvey, Ill.

FURNACES, HEAT TREATING

HARDENING AND TEMPERING

Can. Hoskins, Ltd., Walkerville, Ont.

Gilbert & Barker Mfg. Co., Springfield, Mass.

Tate-Jones & Co., Leetsdale, Pa.

FURNACES, FORGING

Can. Hoskins, Ltd., Walkerville, Ont.

Gilbert & Barker Mfg. Co., Springfield, Mass.

Tate-Jones & Co., Leetsdale, Pa.

FURNACES FOR BAKING, BLUING,

DYEING, ENAMELING, JAPANNING

AND LACQUERING

Can. Hoskins, Ltd., Walkerville, Ont.

Erie Foundry Co., Erie, Pa.

FUSE BOXES, STEEL

Tom Long & Stng. Co., Walkerville, Ont.

FUSE CAP MACHINERY

Graton & Knight Mfg. Co., Montreal.

H. E. T. Pringle, Ltd., Toronto.

GAUGES, MERCURY COLUMN, DRAFT

Charles F. Elmes Eng. Works, Chicago.

GAUGES, HYDRAULIC

Tasler Instrument Co., Rochester, N.Y.

GAUGES, STANDARD

Can. Fairbanks-Morse Co., Montreal.

Cleveland Twist Drill Co., Cleveland.

Garson Machine Co., New York.

Hoskins Tool Works, Chicago, Ill.

Horse Twist Drill & Machine Co., New Bedford.

Osborn (Canada), Ltd., Sam'l, Montreal, Que.

Pratt & Whitney Co., Hartford, Conn.

Toronto Tool Works, Toronto, Ont.

Wells & Bates Co. of Canada, Galt, Ont.

Worth Engineering Co., Toronto, Ont.

GEAR BLANKS

Can. Steel Foundries, Ltd., Montreal, Que.

GEAR-CUTTING MACHINERY

Bridport Mach. Tool Works, Rochester, N.Y.

Dominion Machinery Co., Toronto.

Garlock-Walker Machinery Co., Toronto, Ont.

Hoskins Tool Works, Chicago, Ill.

H. W. Petrie, Ltd., Montreal.

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GEAR TURNING MACHINES, BEND

Bridport Mach. Tool Works, Rochester, N.Y.

GEARS, CUT, MORTISE, ANGLE, WORM

Baxter Co., Ltd., J. R., Montreal, Que.

Gardner, Robt., & Son, Montreal.

Grant Gear Works, Boston, Mass.

Hamilton Gear & Machine Co., Toronto.

Hull Iron & Steel Foundries, Ltd., Hull, Que.

The Jencks Mach. Co., Ltd., Sherbrooke, Que.

Wm. Kennedy & Sons, Ltd., Owen Sound, Ont.

Philadelphia Gear Works, Philadelphia, Pa.

The Smart-Turner Machine Co., Hamilton.

Winnipeg Gear & Engr. Co., Winnipeg, Man.

GEARS, RAWHIDE

Hamilton Gear & Machine Co., Toronto.

Gardner, Robt., & Son, Montreal.

Grant Gear Works, Boston, Mass.

Philadelphia Gear Works, Philadelphia, Pa.

A. R. Williams Machy. Co., Toronto.

Winnipeg Gear & Engr. Co., Winnipeg, Man.

GENERATORS, ELECTRIC

Can. Fairbanks-Morse Co., Montreal.

Dominion Machinery Co., Toronto, Ont.

Lancashire Dynamo & Motor Co., Toronto.

H. W. Petrie, Ltd., Montreal.

H. W. Petrie, Toronto.

Sturtevant Co., E. F. Galt, Ont.

A. R. Williams Machy. Co., Toronto.

GLASSES, SAFETY

Strong, Kennard & Nutt Co., Cleveland, Ohio.

Hillson & Co. Inc., New York, Reading, Pa.

GRAIN FOR POLISHING

Norton Co., Worcester, Mass.

GRAPHITE

Aikenhead Hardware Co., Toronto, Ont.

Standard Machy. & Supplies, Ltd., Montreal, Que.

GLOVES, LEATHER AND RUBBER

Hickory Steel-Grip Glove Co., Chicago, Ill.

GLOVES, STEEL GRIP

Hickory Steel Grip Glove Co., Chicago, Ill.

GLOVES, SAND BLAST

Hickory Steel-Grip Glove Co., Chicago, Ill.

GRAVITY CARRIERS

Can. Matthews Gravity Carrier Co., Toronto, Ont.

GREASES (SEE LUBRICANTS)**GRINDER ATTACHMENTS**

Rivett Lathe & Grinder Co., Boston, Mass.

Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, AUTOMATIC KNIFE

W. H. Ranfield & Son, Toronto.

Canada Machinery Corp., Galt, Ont.

Foss & Hill Machy. Co., Montreal.

Garlock-Walker Machinery Co., Toronto, Ont.

GRINDERS, CENTRE COLUMN, PEDESTAL

AND BENCH

Blake & Johnson Co., Waterbury, Conn.

Can. Bond Hanger & Cplg. Co., Alexandria, Ont.

Canada Machinery Corp., Galt, Ont.

Cleveland Pneumatic Tool Co. of Canada, Toronto.

Ford-Smith Mach. Co., Hamilton, Ont.

Foss & Hill Machy. Co., Montreal.

Garlock-Walker Machinery Co., Toronto, Ont.

Niles-Bement-Pond Co., New York.

Modern Tool Co., Erie, Pa.

Morse Twist Drill & Machine Co., New Bedford.

New Britain Machine Co., New Britain, Conn.

H. W. Petrie, Ltd., Montreal.

H. W. Petrie, Toronto.

R. E. T. Pringle, Ltd., Toronto, Ont.

Stow Mfg. Co., Binghamton, N.Y.

United States Electrical Tool Co., Cincinnati, O.

GRINDERS, CUTTER

Brown & Sharpe Mfg. Co., Providence, R.I.

Foss & Hill Machy. Co., Montreal.

Greenfield Machine Co., Greenfield, Mass.

LeBlond Mach. Tool Co., R. K., Cincinnati, O.

Norton Grinding Co., Worcester, Mass.

Pratt & Whitney Co., Dundas, Ont.

Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, DIE AND CHASER

Lands Machine Co., Waynesboro, Pa.

Modern Tool Co., Erie, Pa.

National-Acme Co., Cleveland, Ohio.

GRINDERS, DISK

Armstrong Bros. Tool Co., Chicago, Ill.

Ford-Smith Mach. Co., Hamilton, Ont.

Gardner Machine Co., Beloit, Wis.

GRINDERS, DRILL

Aikenhead Hardware Co., Toronto, Ont.

Foss & Hill Machy. Co., Montreal.

Garvin Machine Co., New York, N.Y.

United States Electrical Tool Co., Cincinnati, O.

Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, CYLINDER, INTERNAL

Brown & Sharpe Mfg. Co., Providence, R.I.

Fitchburg Grinding Mach. Co., Fitchburg, Mass.

Foss & Hill Machy. Co., Montreal.

Greenfield Machine Co., Greenfield, Mass.

Modern Tool Co., Erie, Pa.

Norton Grinding Co., Worcester, Mass.

R. E. T. Pringle, Ltd., Toronto, Ont.

Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, PNEUMATIC

Can. Ingersoll-Rand Co., Sherbrooke, Que.

Cleveland Pneumatic Tool Co. of Canada, Toronto.

Garlock-Walker Machinery Co., Toronto, Ont.

Foulmerford Pneumatic Tool Co., Chicago, Ill.

GRINDERS, PORTABLE, ELECTRIC

HAND, TOOL, POST, FLOOR AND BENCH

Baird Machine Co., Bridgeport, Conn.

Brown & Sharpe Mfg. Co., Providence, R.I.

Can. Bond Hanger & Cplg. Co., Alexandria, Ont.

Canada Machinery Corp., Galt, Ont.

Cleveland Pneumatic Tool Co. of Canada, Toronto.

Dominion Machinery Co., Toronto, Ont.

Ford-Smith Mach. Co., Hamilton, Ont.

Foss & Hill Machy. Co., Montreal.

Grant Mfg. & Machine Co., Bridgeport, Conn.

Garlock-Walker Machinery Co., Toronto, Ont.

Greenfield Machine Co., Greenfield, Mass.

Independent Pneumatic Tool Co., Chicago.

Norton Co., Worcester, Mass.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

R. E. T. Pringle, Ltd., Toronto, Ont.

United States Electrical Tool Co., Cincinnati, O.

A. R. Williams Machy. Co., Toronto.

GRINDERS, RADIAL

Rivett Lathe & Grinder Co., Brighton, Mass.

GRINDERS, TOOL AND HOLDER

Armstrong Bros. Tool Co., Chicago.

W. F. & John Barnes Co., Rockford, Ill.

Blake & Johnson Co., Waterbury, Conn.

Blount, J. G., & Co., Everett, Mass.

Brown & Sharpe Mfg. Co., Providence, R.I.

Ford-Smith Machy. Co., Hamilton, Ont.

Greenfield Machine Co., Greenfield, Mass.

National-Acme Co., Cleveland, Ohio.

H. W. Petrie, Ltd., Montreal.

Tabor Mfg. Co., Philadelphia, Pa.

Wing & Son, J. E., Hamilton, Ont.

GRINDERS, UNIVERSAL, PLAIN

Fitchburg Grinding Machine Co., Fitchburg, Mass.

Modern Tool Co., Erie, Pa.

Wilmarth & Morman, Grand Rapids, Mich.

GRINDERS, VERTICAL SURFACE

Brown & Sharpe Mfg. Co., Providence, R.I.

Can. Fairbanks-Morse Co., Montreal.

Pratt & Whitney Co., Dundas, Ont.

H. E. Streeter, New York, Birk's Bldg., Montreal, Que.

Wilmarth & Morman, Grand Rapids, Mich.

Wing & Son, J. E., Hamilton, Ont.

GRINDING AND POLISHING

MACHINES, PORTABLE, PNEUMATIC

AND SPRING FRAME

Can. Fairbanks-Morse Co., Montreal.

Cincinnati Electrical Tool Co., Cincinnati, Ohio.

Ford-Smith Mach. Co., Hamilton, Ont.

Gardner, Robt., & Son, Montreal.

Garvin Machine Co., New York.

Garlock-Walker Machinery Co., Toronto, Ont.

Greenfield Machine Co., Greenfield, Mass.

Hall & Sons, New York, Birk's Bldg., Montreal, Que.

LeBlond Mach. Tool Co., R. K., Cincinnati.

Niles-Bement-Pond Co., New York.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

Wilmarth & Morman, Grand Rapids, Mich.

Stow Mfg. Co., Binghamton, N.Y.

GRINDING WHEELS

Aikenhead Hardware Co., Toronto, Ont.

Baxter Co., Ltd., J. R., Montreal, Que.

Can. Fairbanks-Morse Co., Montreal.

Can. B. K. Morton, Toronto, Montreal.

Carborundum Co., Niagara Falls.

Ford-Smith Mach. Co., Hamilton, Ont.

Foss & Hill Machy. Co., Montreal.

Francis & Co., Hartford, Conn.

Norton Co., Worcester, Mass.

H. W. Petrie, Toronto.

GUARDS, WINDOW AND MACHINE

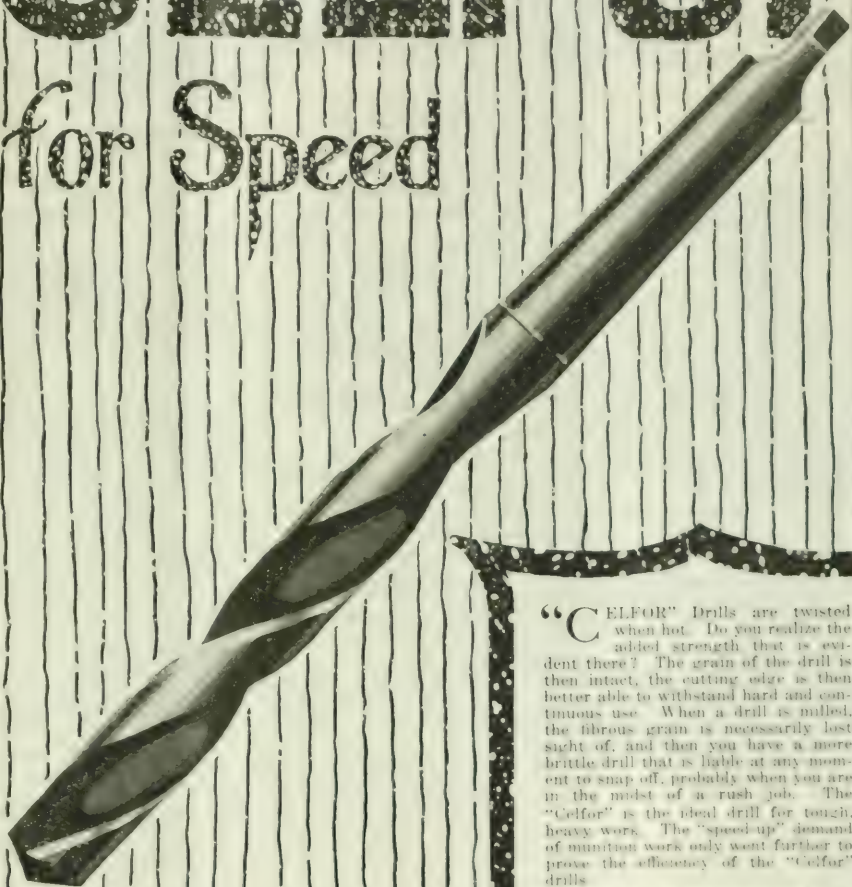
Canada Wire & Iron Goods Co., Hamilton, Ont.

Ford-Smith Machine Co., Hamilton, Ont.

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Hammer & Co., Boston, Mass.

Whitman & Barnes Mfg. Co., St. Catharines, Ont.

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United Hammer Co., Boston, Mass.

HAMMERS, STEAM

John Bertram & Sons Co., Dundas.

Canada Machinery Corp., Galt, Ont.

Eric Foundry Co., Erie, Pa.

Niles-Bement-Pond Co., New York.

HAND LEATHERS OR PADS

Graton & Knight Mfg. Co., Montreal.

Hickory Steelsmiths, Chicago, Ill.

HANGERS, SAW

Haird Machine Co., Bridgeport, Conn.

Can. Bond Hanger & Cplg. Co., Alexandria, Ont.

Can. S. K. P. Co., Toronto, Ont.

Carbide, R. H. & S. S., Montreal.

Perce of Montreal, Ltd., H. W., Montreal, Que.

H. W. Petrie, Toronto.

Standard Pressed Steel Co., Philadelphia, Pa.

HARDENING AND TEMPERING

H. H. H. and A. J. Madison, New York.

Gale, H. and A. J. Madison, New York.

HARDNESS TESTING INSTRUMENTS

Shore Instrument & Mfg. Co., New York.

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Seafie & Sons Co., Wm. B., Pittsburgh, Pa.

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Baird Machine Co., Bridgeport, Conn.

HINGES

London Bolt & Hinge Works, London, Ont.

HOBS

Illinois Tool Works, Chicago, Ill.

Osborn (Canada, Ltd., Sam'l), Montreal, Que.

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Can. Matthews Gravity Carrier Co., Toronto, Ont.

Jerkes Mach. Co., Sherbrooke, Ont.

Marsh & Henthorn, Belleville, Ont.

Northern Crane Works, Walkerville, Ont.

Petrie of Montreal, Ltd., H. W., Montreal, Que.

Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS, CHAIN, ELECTRIC**AND PNEUMATIC**

Can. Ingersoll-Rand Co., Sherbrooke, Que.

Garlock-Walker Machinery Co., Toronto, Ont.

Ford Chain Rope & Mfg. Philadelphia, Pa.

Independent Pneumatic Tool Co., Chicago, Ill.

Jerkes Mach. Co., Sherbrooke, Que.

Marsh & Henthorn, Belleville, Ont.

Northern Crane Works, Walkerville, Ont.

Whiting Foundry Equipment Co., Harvey, Ill.

HOISTS, ELECTRIC

Can. Jerkes Mac Co., Ltd., Sherbrooke, Que.

Kennedy & Sons, Owen Sound, Ont.

Northern Crane Works, Walkerville, Ont.

Winnipeg Gear & Engrg. Co., Winnipeg, Man.

Wright Mfg. Co., Chicago, Ill.

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Garlock-Walker Machinery Co., Toronto, Ont.

Goodyear Tire & Rubber Co., Toronto, Ont.

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Wells Bros. Co. of Canada, Galt, Ont.

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Niles-Bement-Pond Co., New York.

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H. W. Petrie, Toronto.

West Tire Setter Co., Rochester, N.Y.

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Brown & Sharpe Mfg. Co., Providence, R.I.

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L. S. Starrett Co., Athol, Mass.

INDEX CENTRES

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Garrin Machine Co., New York.

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Naumham Crane Works, Walkerville.

Norton, A. O., Cranston, Que.

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Garlock-Walker Machinery Co., Toronto, Ont.

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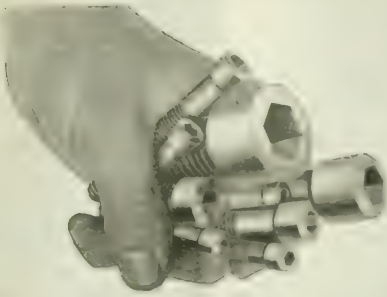
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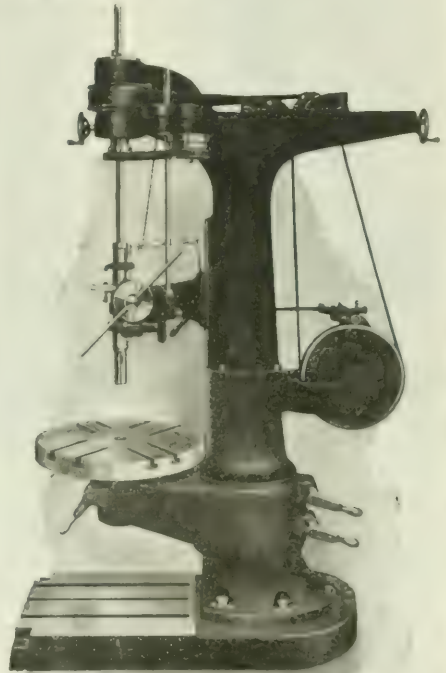


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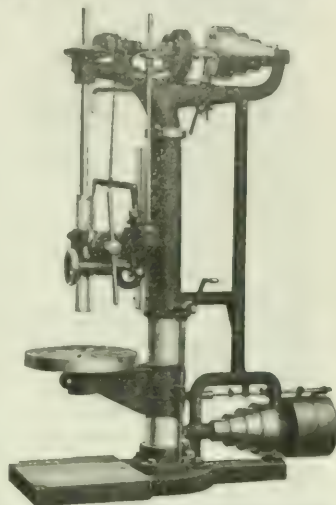
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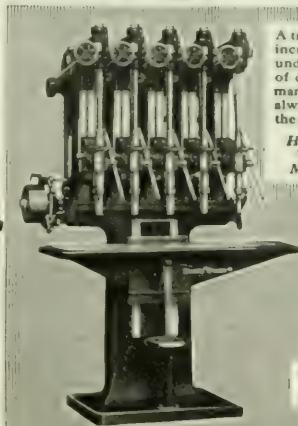
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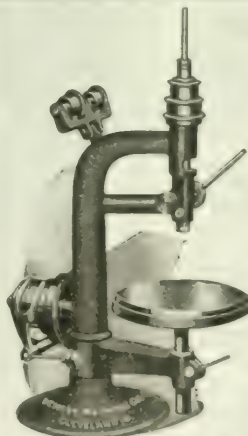
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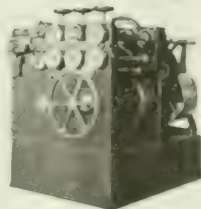
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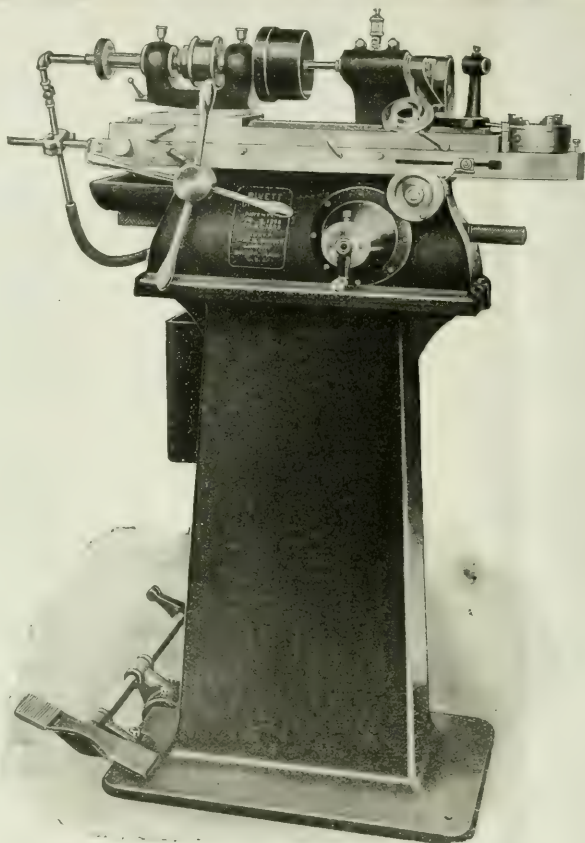
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INDEX TO ADVERTISERS—Continued from page 176

A		B		C		D		E		F		G		H		I		J		K		L		M		N		O		P		Q		R		S		T		U		V		W		X		Y		Z																																																																																																																																																					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100																																																																																																				
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41		42		43		44		45		46		47		48		49		50		51		52		53		54		55		56		57		58		59		60		61		62		63		64		65		66		67		68		69		70		71		72		73		74		75		76		77		78		79		80		81		82		83		84		85		86		87		88		89		90		91		92		93		94		95		96		97		98		99		100	
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CANADIAN MACHINERY

AND MANUFACTURING NEWS

A weekly newspaper devoted to the machinery and manufacturing interests.

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EDITORIAL CONTENTS

UTILIZING A PRE-WAR FACTORY FOR SHELL MACHINING AND FORGING.....	109-111
GENERAL	112
Education of Marine Engineers....Horse Power of Belting.	
PRODUCTION METHODS AND DEVICES	113-114
Another Use for the Lathe....Saving the Hard Casting....Don'ts for Machinists....	
Horse Power Required to Convey Materials....Using Old Principles in New Ways.	
GENERAL	114
Belt Pulley Notes.	
DEVELOPMENT OF OCEAN SERVICE SHIPBUILDING IN CANADA	115
Ocean-Going Oil Tanker Launched at Collingwood...."War Wasp" Launched.	
GENERAL	116
Institute of Metals Convention Programme.	
EDITORIAL CORRESPONDENCE	117-119
Machinists' Instruction Course—XXV....Variation in Shell Forgings....Shell Inspection.	
GENERAL	119
British Admiralty Wants B.C. Lumber....Railway Board to Operate C.N.R. and G.T.P....Stationary Engineers' Convention.	
PROCESSES IN MANUFACTURE	120-123
Hammer-Hour Overhead System for Drop Forge Shops.	
GENERAL	124
New Method of Artificially Loading Generators for Test.	
MERITS OF SOME RECENT DEVELOPMENTS IN AIR PUMP DESIGN	125-131
PROGRESS IN NEW EQUIPMENT	132-135
Universal Gear Hobber....Optical Pyrometer for Works Use....18-inch Engine Lathe With Shell Equipment....Uranium High Speed Steel Tests.	
EDITORIAL	136
The Project to Develop Canadian Trade....U.S. Shipbuilding Deadlock Ended.	
INDUSTRIAL NOTABILITIES	137
William Clark Hawkins.	
SELECTED MARKET QUOTATIONS	138-139
THE GENERAL MARKET CONDITION AND TENDENCY	139-142
Montreal Letter....Toronto Letter....New York Letter....Pittsburgh Letter.	
INDUSTRIAL AND CONSTRUCTION NEWS (Advertising Section)	76

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CHIEF OFFICES:

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BR 5-0498, BR 5-0499, BR 5-0500, BR 5-0501, BR 5-0502, BR 5-0503, BR 5-0504, BR 5-0505, BR 5-0506, BR 5-0507, BR 5-0508, BR 5-0509, BR 5-0510, BR 5-0511, BR 5-0512, BR 5-0513, BR 5-0514, BR 5-0515, BR 5-0516, BR 5-0517, BR 5-0518, BR 5-0519, BR 5-0520, BR 5-0521, BR 5-0522, BR 5-0523, BR 5-0524, BR 5-0525, BR 5-0526, BR 5-0527, BR 5-0528, BR 5-0529, BR 5-0530, BR 5-0531, BR 5-0532, BR 5-0533, BR 5-0534, BR 5-0535, BR 5-0536, BR 5-0537, BR 5-0538, BR 5-0539, BR 5-0540, BR 5-0541, BR 5-0542, BR 5-0543, BR 5-0544, BR 5-0545, BR 5-0546, BR 5-0547, BR 5-0548, BR 5-0549, BR 5-0550, BR 5-0551, BR 5-0552, BR 5-0553, BR 5-0554, BR 5-0555, BR 5-0556, BR 5-0557, BR 5-0558, BR 5-0559, BR 5-0560, BR 5-0561, BR 5-0562, BR 5-0563, BR 5-0564, BR 5-0565, BR 5-0566, BR 5-0567, BR 5-0568, BR 5-0569, BR 5-0570, BR 5-0571, BR 5-0572, BR 5-0573, BR 5-0574, BR 5-0575, BR 5-0576, BR 5-0577, BR 5-0578, BR 5-0579, BR 5-0580, BR 5-0581, BR 5-0582, BR 5-0583, BR 5-0584, BR 5-0585, BR 5-0586, BR 5-0587, BR 5-0588, BR 5-0589, BR 5-0590, BR 5-0591, BR 5-0592, BR 5-0593, BR 5-0594, BR 5-0595, BR 5-0596, BR 5-0597, BR 5-0598, BR 5-0599, BR 5-0600, BR 5-0601, BR 5-0602, BR 5-0603, BR 5-0604, BR 5-0605, BR 5-0606, BR 5-0607, BR 5-0608, BR 5-0609, BR 5-0610, BR 5-0611, BR 5-0612, BR 5-0613, BR 5-0614, BR 5-0615, BR 5-0616, BR 5-0617, BR 5-0618, BR 5-0619, BR 5-0620, BR 5-0621, BR 5-0622, BR 5-0623, BR 5-0624, BR 5-0625, BR 5-0626, BR 5-0627, BR 5-0628, BR 5-0629, BR 5-0630, BR 5-0631, BR 5-0632, BR 5-0633, BR 5-0634, BR 5-0635, BR 5-0636, BR 5-0637, BR 5-0638, BR 5-0639, BR 5-0640, BR 5-0641, BR 5-0642, BR 5-0643, BR 5-0644, BR 5-0645, BR 5-0646, BR 5-0647, BR 5-0648, BR 5-0649, BR 5-0650, BR 5-0651, BR 5-0652, BR 5-0653, BR 5-0654, BR 5-0655, BR 5-0656, BR 5-0657, BR 5-0658, BR 5-0659, BR 5-0660, BR 5-0661, BR 5-0662, BR 5-0663, BR 5-0664, BR 5-0665, BR 5-0666, BR 5-0667, BR 5-0668, BR 5-0669, BR 5-0670, BR 5-0671, BR 5-0672, BR 5-0673, BR 5-0674, BR 5-0675, BR 5-0676, BR 5-0677, BR 5-0678, BR 5-0679, BR 5-0680, BR 5-0681, BR 5-0682, BR 5-0683, BR 5-0684, BR 5-0685, BR 5-0686, BR 5-0687, BR 5-0688, BR 5-0689, BR 5-0690, BR 5-0691, BR 5-0692, BR 5-0693, BR 5-0694, BR 5-0695, BR 5-0696, BR 5-0697, BR 5-0698, BR 5-0699, BR 5-0700, BR 5-0701, BR 5-0702, BR 5-0703, BR 5-0704, BR 5-0705, BR 5-0706, BR 5-0707, BR 5-0708, BR 5-0709, BR 5-0710, BR 5-0711, BR 5-0712, BR 5-0713, BR 5-0714, BR 5-0715, BR 5-0716, BR 5-0717, BR 5-0718, BR 5-0719, BR 5-0720, BR 5-0721, BR 5-0722, BR 5-0723, BR 5-0724, BR 5-0725, BR 5-0726, BR 5-0727, BR 5-0728, BR 5-0729, BR 5-0730, BR 5-0731, BR 5-0732, BR 5-0733, BR 5-0734, BR 5-0735, BR 5-0736, BR 5-0737, BR 5-0738, BR 5-0739, BR 5-0740, BR 5-0741, BR 5-0742, BR 5-0743, BR 5-0744, BR 5-0745, BR 5-0746, BR 5-0747, BR 5-0748, BR 5-0749, BR 5-0750, BR 5-0751, BR 5-0752, BR 5-0753, BR 5-0754, BR 5-0755, BR 5-0756, BR 5-0757, BR 5-0758, BR 5-0759, BR 5-0760, BR 5-0761, BR 5-0762, BR 5-0763, BR 5-0764, BR 5-0765, BR 5-0766, BR 5-0767, BR 5-0768, BR 5-0769, BR 5-0770, BR 5-0771, BR 5-0772, BR 5-0773, BR 5-0774, BR 5-0775, BR 5-0776, BR 5-0777, BR 5-0778, BR 5-0779, BR 5-0780, BR 5-0781, BR 5-0782, BR 5-0783, BR 5-0784, BR 5-0785, BR 5-0786, BR 5-0787, BR 5-0788, BR 5-0789, BR 5-0790, BR 5-0791, BR 5-0792, BR 5-0793, BR 5-0794, BR 5-0795, BR 5-0796, BR 5-0797, BR 5-0798, BR 5-0799, BR 5-0800, BR 5-0801, BR 5-0802, BR 5-0803, BR 5-0804, BR 5-0805, BR 5-0806, BR 5-0807, BR 5-0808, BR 5-0809, BR 5-0810, BR 5-0811, BR 5-0812, BR 5-0813, BR 5-0814, BR 5-0815, BR 5-0816, BR 5-0817, BR 5-0818, BR 5-0819, BR 5-0820, BR 5-0821, BR 5-0822, BR 5-0823, BR 5-0824, BR 5-0825, BR 5-0826, BR 5-0827, BR 5-0828, BR 5-0829, BR 5-0830, BR 5-0831, BR 5-0832, BR 5-0833, BR 5-0834, BR 5-0835, BR 5-0836, BR 5-0837, BR 5-0838, BR 5-0839, BR 5-0840, BR 5-0841, BR 5-0842, BR 5-0843, BR 5-0844, BR 5-0845, BR 5-0846, BR 5-0847, BR 5-0848, BR 5-0849, BR 5-0850, BR 5-0851, BR 5-0852, BR 5-0853, BR 5-0854, BR 5-0855, BR 5-0856, BR 5-0857, BR 5-0858, BR 5-0859, BR 5-0860, BR 5-0861, BR 5-0862, BR 5-0863, BR 5-0864, BR 5-0865, BR 5-0866, BR 5-0867, BR 5-0868, BR 5-0869, BR 5-0870, BR 5-0871, BR 5-0872, BR 5-0873, BR 5-0874, BR 5-0875, BR 5-0876, BR 5-0877, BR 5-0878, BR 5-0879, BR 5-0880, BR 5-0881, BR 5-0882, BR 5-0883, BR 5-0884, BR 5-0885, BR 5-0886, BR 5-0887, BR 5-0888, BR 5-0889, BR 5-0890, BR 5-0891, BR 5-0892, BR 5-0893, BR 5-0894, BR 5-0895, BR 5-0896, BR 5-0897, BR 5-0898, BR 5-0899, BR 5-0900, BR 5-0901, BR 5-0902, BR 5-0903, BR 5-0904, BR 5-0905, BR 5-0906, BR 5-0907, BR 5-0908, BR 5-0909, BR 5-0910, BR 5-0911, BR 5-0912, BR 5-0913, BR 5-0914, BR 5-0915, BR 5-0916, BR 5-0917, BR 5-0918, BR 5-0919, BR 5-0920, BR 5-0921, BR 5-0922, BR 5-0923, BR 5-0924, BR 5-0925, BR 5-0926, BR 5-0927, BR 5-0928, BR 5-0929, BR 5-0930, BR 5-0931, BR 5-0932, BR 5-0933, BR 5-0934, BR 5-0935, BR 5-0936, BR 5-0937, BR 5-0938, BR 5-0939, BR 5-0940, BR 5-0941, BR 5-0942, BR 5-0943, BR 5-0944, BR 5-0945, BR 5-0946, BR 5-0947, BR 5-0948, BR 5-0949, BR 5-0950, BR 5-0951, BR 5-0952, BR 5-0953, BR 5-0954, BR 5-0955, BR 5-0956, BR 5-0957, BR 5-0958, BR 5-0959, BR 5-0960, BR 5-0961, BR 5-0962, BR 5-0963, BR 5-0964, BR 5-0965, BR 5-0966, BR 5-0967, BR 5-0968, BR 5-0969, BR 5-0970, BR 5-0971, BR 5-0972, BR 5-0973, BR 5-0974, BR 5-0975, BR 5-0976, BR 5-0977, BR 5-0978, BR 5-0979, BR 5-0980, BR 5-0981, BR 5-0982, BR 5-0983, BR 5-0984, BR 5-0985, BR 5-0986, BR 5-0987, BR 5-0988, BR 5-0989, BR 5-0990, BR 5-0991, BR 5-0992, BR 5-0993, BR 5-0994, BR 5-0995, BR 5-0996, BR 5-0997, BR 5-0998, BR 5-0999, BR 5-1000, BR 5-1001, BR 5-1002, BR 5-1003, BR 5-1004, BR 5-1005, BR 5-1006, BR 5-1007, BR 5-1008, BR 5-1009, BR 5-1010, BR 5-1011, BR 5-1012, BR 5-1013, BR 5-1014, BR 5-1015, BR 5-1016, BR 5-1017, BR 5-1018, BR 5-1019, BR 5-1020, BR 5-1021, BR 5-1022, BR 5-1023, BR 5-1024, BR 5-1025, BR 5-1026, BR 5-1027, BR 5-1028, BR 5-1029, BR 5-1030, BR 5-1031, BR 5-1032, BR 5-1033, BR 5-1034, BR 5-1035, BR 5-1036, BR 5-1037, BR 5-1038, BR 5-1039, BR 5-1040, BR 5-1041, BR 5-1042, BR 5-1043, 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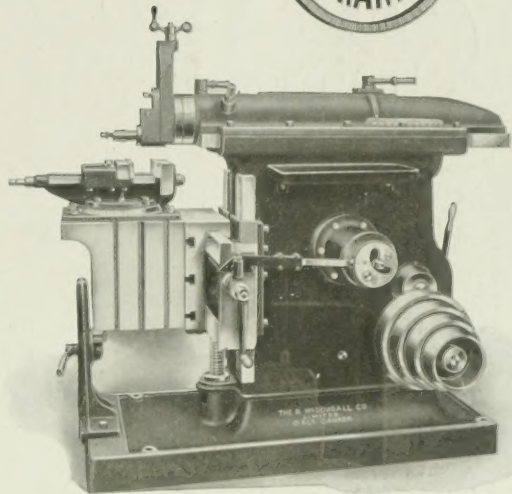
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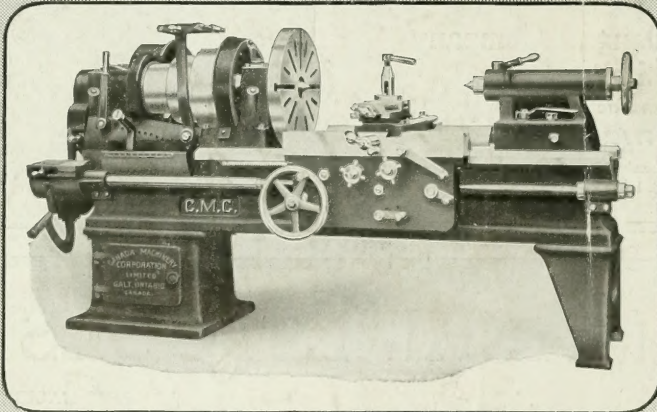
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